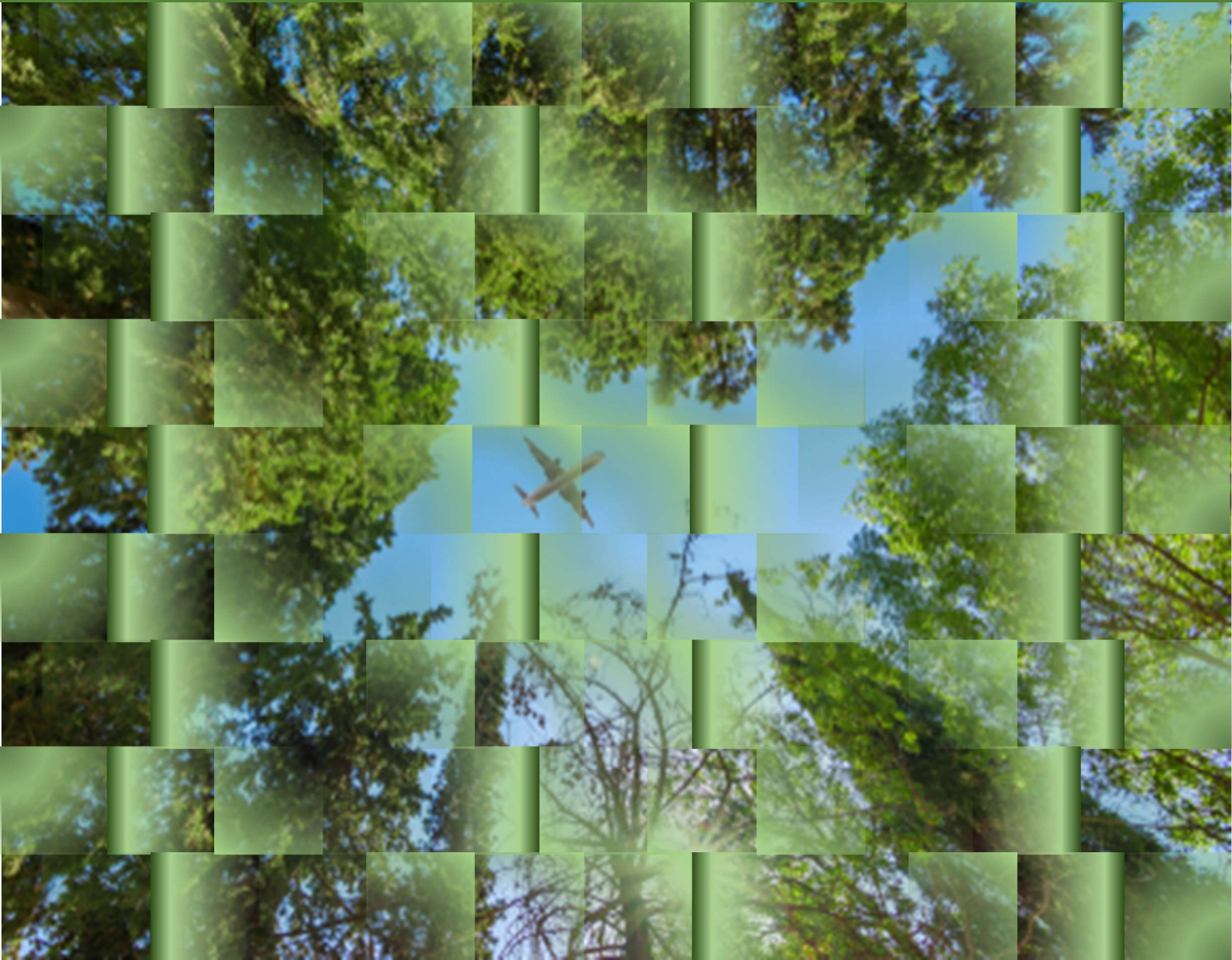




# GREEN AND SUSTAINABLE FLYING



**Second edition**



## ERA's airline members



ERA (European Regions Airline Association) is the trade association representing more than 55 airlines and over 130 associate members, including manufacturers, airports, suppliers and aviation service providers, across the entire spectrum of the aviation industry. The power of one collective voice, representing multiple businesses, to promote and protect one industry sector is incredibly strong.

ERA works on behalf of its members to represent their interests before Europe's major regulatory bodies, governments and legislators to encourage and develop long-term and sustainable growth for the sector and industry. The association also brings members together to exchange information and learn from each other through events, groups, meetings and forums. A major part of ERA's role is to raise the profile and importance of its members, to champion green and sustainable air connectivity and European air transport.



**56 airlines**



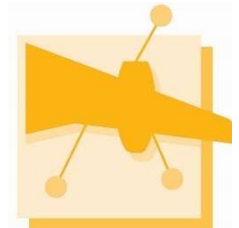
**13 manufacturers**



**17 airports**



**68 suppliers**



**59 aviation services**



## 1. Introduction

Aviation's benefits to Europe's society and economy are well known. The sector has increased connectivity throughout the regions in Europe, contributed to economic development, and greatly facilitated the transportation of people and goods. During the last decade, passenger traffic has enjoyed remarkable growth despite being adversely affected by the Coronavirus pandemic. However, in recent years, political and public scrutiny and pressure on the industry has increased. The forecasted climate impact has resulted in sustainability and aviation's environmental impact becoming a top priority at both an international and European level.

At an international level, the ratification of the Paris Agreement in 2016 set new targets for the global community, including maintaining the global temperature increase to well below 2°C above pre-industrial levels and to pursue efforts to keep it below 1.5°C.<sup>1</sup> At European level, the European Commission (EC) presented the European Green Deal in 2019, which set a new growth strategy for the European Union (EU) with the objective of becoming the first climate-neutral continent by 2050. To achieve such an objective, the EU is calling on all sectors of the economy and transport modes to take action, and aviation is no exception.

This is a key period for climate change policies in the aviation industry. In October 2022, the 41st International Civil Aviation Organisation (ICAO) Assembly will agree on the global sector's Long Term Aspirational Goal (LTAG) and review the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). At the date of the publication of this report, discussions are taking place in Europe on the Fit for 55 (Ff55) package, a set of proposals that will allow the European economy to achieve the EU's goal of 55 per cent reduction of CO<sub>2</sub> by 2030, economy wide. The most relevant proposals for ERA members are:

- the EU Emissions Trading System (EU ETS);
- ReFuelEU Aviation; and
- Energy Taxation Directive.

Whilst the COVID-19 crisis has significantly impacted the industry, environmental issues are still very much at the top of the agenda for the aviation sector and ERA's members. In 2020, ERA, together with other aviation organisations, published the Aviation Round Table (ART) report, which outlines the main asks of the industry to regulators to recover from the crisis and identifies sustainability as a key achievement to meet in order for the sector to build back better.

For years the aviation sector has focussed on solutions to reduce its carbon footprint and more recently the European aviation sector has further committed to reach the EU's climate targets of CO<sub>2</sub> reduction and climate neutrality. ERA and four other European aviation associations,<sup>2</sup> representing airlines, airports, aerospace manufacturers and air navigation service providers, published [Destination 2050: A route to net zero European aviation](#), which shows alignment with the EU's own climate goals by addressing four pillars: improvement in technology, improvement in ATM and operations, use of sustainable aviation fuels (SAF) and use of smart economic measures, such as EU ETS and CORSIA.

Following the publication of this industry report, in February 2022, the [Toulouse Declaration](#), the first-ever public-private initiative supporting aviation's decarbonisation goals, was signed by 35 European countries and 146 industry stakeholders

(including the Destination 2050 partners). The Declaration is fully aligned with the sector's collective European and global initiative (Waypoint 2050)<sup>3</sup> to achieve net zero CO<sub>2</sub> emissions by 2050.

Throughout Europe especially, national measures are either being developed or proposed that could slow down the advancement of sustainability in the sector, such as proposals of EU or national 'green' taxes and the banning of short-haul routes. As such, to ensure the long-term sustainability of the sector, it is necessary that policymakers develop the right policy framework that will allow the sector to decarbonise.

Regional airlines are the most vulnerable to these proposals, despite emitting a small fraction of emissions (4.3 per cent of European air transport emissions<sup>4</sup>). This sector finds itself in a conflict between innovation and the political and public pressure to reduce passenger volumes, as recently there have been various announcements throughout Europe on the banning of short-haul routes in order to reduce the environmental impact of aviation. The regional sector is finding itself justifying the very purpose of its existence: **providing connectivity in European regions**. ERA airline members connect parts of Europe where air transport is both vital and often the only mode of transportation available to inhabitants, such as in remote regions, islands and dispersed areas.

However, the regional sector, characterised by short-haul flights, lends itself to new and clean technologies and should be the forerunner for testing and selecting the right technology needed to decarbonise the industry. The short-haul segment is creating the necessary push towards the decarbonisation of the sector, providing the testing ground for new technologies that will enable the green transition to a more sustainable industry. Electric and hydrogen-powered aircraft, for example, will first be made available on short-haul routes by 2035 and then on longer routes beyond 2050.

This *Green and Sustainable Flying* report, therefore, outlines the work undertaken by regional aviation stakeholders, particularly our airlines, to tackle environmental concerns. The regional market presents a different type of demand and services that render regional airlines unique and essential in some regions, for example, where there is no alternative to flying. ERA's airline members provide vital connectivity and support for Europe's regions, promoting social and territorial equality and cohesion, as well as contributing to increased tourism and investment. All of this leads to positive social impacts as it facilitates European integration and contributes to sustainable development by providing essential transport links and job creation.

ERA and its members are committed to making sustainable flying a reality. As stated in the first edition of the *Green and Sustainable Connectivity* report:

"Not flying is not an option for many people given the benefits that aviation brings, and passengers should not be faced with the dilemma 'to fly or not fly', we should rather strive to fly sustainably."<sup>5</sup>

## 2. ERA members and the role of regional connectivity

The aviation sector contributes significantly to the European economy and to the competitiveness of the region. With approximately 1.2 billion passengers flying on more than 9.112 million flights,<sup>6</sup> the European aviation market contributes €966bn

<sup>1</sup> Paris Agreement (2016).

<sup>2</sup> A4E, ACI, ASD and CANSO.

<sup>3</sup> Waypoint 2050 (2021).

<sup>4</sup> EUROCONTROL [Data Snapshot #4 on CO<sub>2</sub> emissions by flight distance](#).

<sup>5</sup> ERA, [Green and Sustainable Connectivity report](#) (2020).

<sup>6</sup> ATAG, [Aviation: Benefits Beyond Borders](#) (2020).

to European economic activity – representing 3.6 per cent of all employment and 4.4 per cent of Europe’s GDP.

ERA members represent a substantial component of European air transport contributing hugely to economic growth within Europe by:

- operating 850,000 million flights;
- on 1,500 routes;
- carrying more than 52 million passengers per annum.

### Connecting people and regions

ERA members provide a niche service as they operate in the parts of Europe where air transport is both vital and often the only mode available to inhabitants in remote regions, islands and dispersed areas, such as in the Canary Islands and in the north of Norway. EU Member States may award public service obligation (PSO) routes to maintain appropriate schedules for air services on routes which are vital for the economic development of the region they serve. They are crucial as they promote connectivity and ensure territorial cohesion, economic and social development in remote regions and islands on air routes that would otherwise not be economically viable under certain conditions.

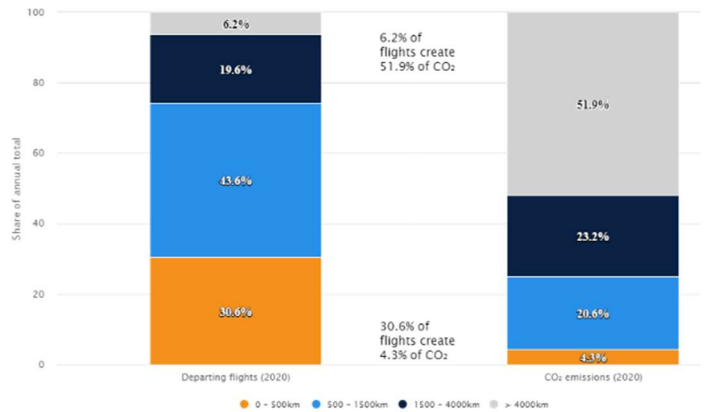
This air connectivity allows passengers to travel for business or leisure and to visit friends and family, and many ERA airline members represent the only link to mainland Europe. Given that regional airlines generally have smaller-capacity aircraft, passengers can fly to smaller cities and to main hubs via more direct, point-to-point routes enabling air connectivity and allowing smaller regions to compete within Europe and the rest of the world. Point-to-point routes also represent a more sustainable alternative compared to indirect flights with stopovers, as they result in fewer take offs and landings, which are quite carbon-intensive phases of a flight.<sup>7</sup>

### Short-haul flying

Discussions in Europe are mainly focussed on a shift from air to rail as a more sustainable alternative to travel. However, the discourse fails to account for all effects of this shift, such as the CO<sub>2</sub> impact of building new railway, capacity constraints, load factors, impacts on biodiversity, noise, and costs to name just a few. Time, in particular, is also an important factor to consider, not only the time needed to build new railways but also for the administrative procedures for permits within a country, let alone cross-country railways.

**Short-haul flight bans** currently being announced can delay progress towards decarbonising rather than helping efforts towards a more sustainable air transport sector, as technological improvements in regional aviation, together with sustainable aviation fuels, offer the best and quickest solution to the decarbonisation of aviation by 2050.

The environmental gain achieved by banning short-haul flights is very minimal as routes of less than 500km only represent a very small part of European air transport emissions (4.3 per cent, see figure below).<sup>8</sup>



Source: EUROCONTROL Data Snapshot #4 on CO<sub>2</sub> emissions by flight distance

Further to this, the short-haul segment is creating the necessary push towards the decarbonisation of the sector, providing the testing ground for new technologies that will enable the green transition to a more sustainable industry. Aviation is already advanced in its development of breakthrough technologies with zero or limited environmental impacts, and will be ready to integrate these into the market within a much shorter timeframe than it will take to build a new rail network. Electric and hydrogen-powered aircraft, for example, are expected to be made first available on short-haul routes by 2035 and then on longer routes beyond 2050.

For further conclusions regarding the banning of short-haul flights and the factors to be considered in a modal shift, please see the Oxera study published in March 2022: [Short-haul flight and sustainable connectivity](#).

### 3. European aviation’s commitment to net zero CO<sub>2</sub> emissions

The European aviation industry has committed to play its part in the green transition. In the spring of 2021, five associations representing airlines (including regional operators), manufacturers, airports, and air service navigation providers published [Destination 2050 – A route to net zero European aviation](#). This report outlines a roadmap for the sector to decarbonise significantly by 2030 and reach net zero CO<sub>2</sub> emissions by 2050. The stakeholders have committed to:

- Reaching net zero CO<sub>2</sub> emissions by 2050 from all flights departing from the EU.
- Reducing net CO<sub>2</sub> emissions from all flights within and departing from the EU by 45 per cent by 2030 compared to the baseline.
- Assessing the feasibility of making 2019 the peak year for absolute CO<sub>2</sub> emissions from flights within and departing from the EU.<sup>9</sup>

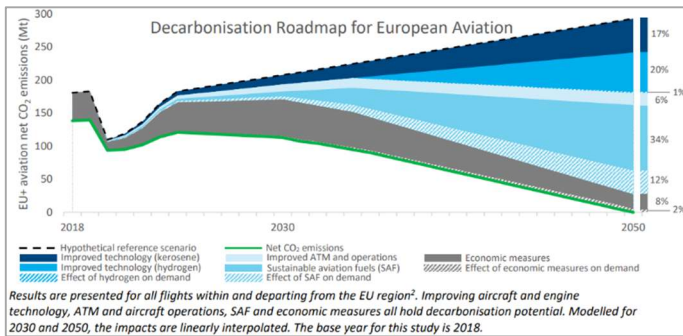
These commitments will be achieved via a combination of measures that include improvements in technology, improvements in ATM and operations, use of sustainable aviation fuels, and use of smart economic measures.<sup>10</sup>

<sup>7</sup> ATAG, [Four ways to fly more sustainably](#) (2018).

<sup>8</sup> EUROCONTROL [Data Snapshot #4 on CO<sub>2</sub> emissions by flight distance](#).

<sup>9</sup> [Destination 2050 – A route to net zero European Aviation](#).

<sup>10</sup> Addresses commercial flights departing from the EU+ (EU, UK, EFTA) airports.



Source: Destination 2050 – A route to net zero European aviation.<sup>11</sup>

The report forecasts that the ambitious 2030 and 2050 targets can be achieved, however, only with strong policy frameworks at European level and via collaboration between the entire aviation ecosystem and regulators. The industry cannot do it alone.

The following paragraphs outline the four pillars of the *Destination 2050* report in more detail and illustrate some of our member's initiatives to address each of these.

*Destination 2050* forecasts that by 2050, **aircraft and engine technology improvements** and fleet replacement could be responsible for 38 per cent of CO<sub>2</sub> reductions. These substantial emissions savings can be achieved via the introduction of hydrogen-powered aircraft on intra-EU routes in 2035, a step-change in energy efficiency of aircraft that needs to be developed within the next 10 years, and an increased optimisation of range and capacity of hybrid-electric aircraft. However, for this to happen it requires technology readiness by 2027–2030, new, efficient certification procedures for disruptive technologies and accelerated fleet renewal.

The reduction of CO<sub>2</sub> emissions with technological improvements is the preferred solution of ERA members as it brings actual in-sector CO<sub>2</sub> emission reductions. Many ERA member airlines are firstly looking to modernise their fleet by integrating state-of-the-art, fuel-efficient, quieter aircraft available on the market today. Secondly, they are entering into partnerships with manufacturers and academia to further investigate the potential of disruptive technologies and accelerate their development. For example, they are looking at the development of either hybrid or all-electric aircraft by replacing conventional engines with battery electric engines or with a hydrogen fuel cell.

For the short to medium term, improvements in **ATM and aircraft operations** are crucial. Developments in this pillar are expected to contribute to six per cent of CO<sub>2</sub> emission reductions. These include airline operations, ATM improvements and ground operations. Most of these CO<sub>2</sub> reductions could be realised by 2035 with the implementation of Single European Sky (SES), if innovation in communication, navigation and surveillance is sped up, if rapid decarbonisation of ground operations is enabled and, finally, if research and development (R&D) continues to be supported to ensure the progress of new technology development and deployment in this field.

Some of our members' initiatives being implemented include:

- fuel use reduction;
- optimisation of fuel lift;
- route optimisation via, for example, flight planning system software;
- accurate planning information;
- reduction of taxi time when permitted;
- optimum take-off configuration;

- optimum take-off thrust;
- minimising auxiliary power unit (APU) usage;
- air conditioning set-up during taxi, take off and flight operations;
- optimum landing procedures;
- continuous climb and descent operations (CCO/CDO);
- satellite-based vertical approaches;
- aerodynamic optimisation (e.g. via engine washing); and
- weight reduction.

The third pillar addresses **SAFs**, which represent the biggest potential of CO<sub>2</sub> reductions by 2050: 46 per cent of the CO<sub>2</sub> emission reductions, where the supply of SAF is expected to account for 83 per cent of the total fuel consumption. However, to make this a reality it is important to address the current challenges. SAF production and deployment must be scaled up whilst ensuring robust and transparent sustainability criteria and a diversified and sustainable feedstock base (from wastes, residues, non-food crops and e-fuels). Finally, an increase in the blending ratio would be necessary, from 50 to 100 per cent.

ERA airline members are committing to using SAF beyond the mandated targets. For example, **Air Nostrum** is committing to use 10 per cent of SAF in its operations by 2030. Members are also participating in test flights to allow 100 per cent of SAF certification for aircraft. For example, **Braathens Regional Airlines (BRA)** in June 2022 flew the first test flight with 100 per cent SAF in an ATR72-600. Finally, in the short term, **market-based measures** (MBMs), like EU ETS and CORSIA, will be crucial. By 2030, MBMs could be responsible for 27 per cent of CO<sub>2</sub> reductions, while by 2050, MBMs will be responsible for 10 per cent of the CO<sub>2</sub> reductions, as the sector will rely more on in-sector reductions offered by new technologies and SAFs.

ERA member airlines comply with the EU ETS and CORSIA requirements for their operations. Some have also introduced carbon offsetting – a compensation mechanism for CO<sub>2</sub> emissions. The members prioritise local projects mainly. For example, Air Corsica supports carbon offsetting projects that directly impact the island territory; whilst Air Nostrum supports Valencian community projects.

#### 4. ERA members' initiatives

Despite the COVID-19 crisis, ERA members still have sustainability at the top of their agendas. As such, they are undertaking different initiatives and projects to address the challenge. These initiatives are outlined in the upcoming pages and will be updated on a recurring basis as ERA members launch new initiatives and projects. The list is non-exhaustive as it outlines only a few, recent examples. You will find older initiatives [here](#).

Examples of ERA airline member initiatives:

- Air Corsica;
- Air Nostrum;
- Amelia;
- Flugfölag Islands (Icelandair);
- KLM Cityhopper;
- SATA Açores Airlines; and
- SKY express.

Examples of other ERA member initiatives:

- Collins Aerospace;
- Thales;
- Universal Hydrogen; and
- ZeroAvia.

<sup>11</sup> [Destination 2050 – A route to net zero European Aviation.](#)



As the leading airline and fourth largest company in Corsica with over 700 employees, Air Corsica is giving a new dimension to its sustainable development and Corporate Social Responsibility (CSR) Policy.

Deployed under the banner 'Ambizione 2025', Air Corsica's CSR strategy is based on three pillars:

1. To reinforce and promote common values (identity, proximity, ethics, experience, performance, health and safety, trust and collaborative work, and so in) in its daily work internally, and with its partners, as well as in the quality of service to its customers.
2. Improving the environmental performance of its activity: 70 per cent of the fleet renewed and 16 per cent reduction in CO<sub>2</sub> emissions by 2025, the first French airline to deploy selective sorting on board all its aircraft, investments in research and energy innovation.
3. To amplify its social and territorial anchorage with an emphasis on the training of personnel, awareness of the island's youth of the air transport sector and the enhancement of Air Corsica's involvement in the Corsican socio-cultural fabric through more than 200 associations and partners.

Air Corsica has decided to associate each value with objectives to be achieved by 2025, taking 2019 as the reference year.



To reduce our greenhouse gas (GHG) emissions into the atmosphere, Air Corsica is committed to implementing a modern and ambitious policy, based on the modernisation of its air fleet, the reduction of general fuel consumption and aircraft weight. Air Corsica undertakes to finance projects to offset its CO<sub>2</sub> emissions. The synergy between these actions will limit our carbon footprint and reduce our CO<sub>2</sub>

emissions by 16 per cent per seat/km by 2025, compared to 2019.



**Actions on the ground and in flight operations:**

- **Promote eco-piloting:** optimisation of fuel uplift, choice of routes and flight plans, adapting speed and optimisation of routes. On the ground; APU using best practices, taxiing with an engine off.
- **Optimisation of flights and LTO phases**, in particular aircraft trajectories, by encouraging visual approaches, which make it possible to delay the transition to landing configuration and the fuel flow in landing configuration corresponding to approximately 150 per cent of the fuel flow in so-called 'smooth' configuration.
- The implementation of **required navigation performance (RNP)**, a flight procedure that relies on satellite positioning and other modern flight management systems during the final approach of an aircraft. This system allows flexibility in designing more predictable and efficient arrival paths, and to perform continuous descent approaches.
- Strive for **environmental efficiency** with exemplary employee behaviour in ground and flight operations.
- Use **environmentally friendly equipment:** electric cars, 440hz park generators, all equipment necessary for ground operation.
- The implementation of **good practices such as engine washing** or the renewal of aircraft engines at more appropriate frequencies. **Reach 25 per cent of the total used in 2025.**
- Install **electric charging stations** for vehicles including visitors.
- Invest in **buildings that respect environmental standards** while improving working conditions.
- Offer **passengers environmentally sensitive services:** improve punctuality, reduce complaint processing times, improve the relationship of trust.
- In 2020, since the COVID-19 crisis, **Air Corsica no longer distributes press materials on board.** The latter is committed, by 2025, to the establishment of an electronic press service on board. The figures obtained for 2020 correspond to a single quarter of press support distribution, with a **75 per cent drop in the weight of press material on board.**
- **Recycle, reduce and recover waste:** widespread selective sorting on board and on the ground.
- **Zero paper on board.**
- **Drinking water fill-ups on A320 have been halved** from September 2020, limiting aircraft load and therefore kerosene consumption.

## Actions on the fleet



### EVOLUTION OF FLEET



## Compensation of CO<sub>2</sub> emissions

To reduce its impact on the environment, Air Corsica undertakes to define and implement a plan to reduce and improve overall energy consumption linked to its activity. The implementation of this new energy policy requires better control of energy consumption during ground operations, and the use of renewable energies for our various technical and administrative buildings throughout Corsica.

Air Corsica wishes to offset the remaining CO<sub>2</sub> emissions generated by its activity, by supporting the development of carbon offset projects directly impacting the island territory. The financing of projects allowing the capture of atmospheric carbon (captured emissions): restoration of degraded ecosystems, cultivation of species with a high potential for CO<sub>2</sub> capture.



Air Nostrum's business strategy has been linked to a strong environmental commitment from the very beginning, as demonstrated in 2004 when it implemented an Environmental Management System according to the ISO 14001:2015 standard, becoming the first regional airline to obtain this certification. Since then, it has been adapting its systems to legislative requirements and stakeholder demands, focussing on projects aimed at reducing its carbon footprint day by day.

Air Nostrum understands the main environmental impact of its activity is CO<sub>2</sub> emissions into the atmosphere. It is therefore committed to continue to work on reducing greenhouse gas emissions to advance towards decarbonisation, in line with the targets of the international community.

To this end, the airline has launched a set of projects that pursue sustainable growth linked to the company's philosophy and strategic goals.

Based on the pillars of *Destination 2050*, the main projects are as follows:

### Technology

With regard to disruptive technologies, Air Nostrum worked hard in 2021 to be at the forefront of what will be the true future of regional aviation decarbonisation. Three projects are leading this process:

**Development of the all-electric aircraft project:** Led by Volotea, Air Nostrum and Dante Aeronautical, this is a circular economy project aimed at replacing conventional engines with battery electric engines. The close-ups and images of what will become the first prototype of an all-electric aircraft show that achieving more sustainable aircraft is closer than ever to becoming a reality. It is expected that by 2024 the aircraft will be approved to fly.

Its development will bring about the following benefits:

1. Zero-emission flights.
2. Aircraft over 40 per cent more efficient than conventional aircraft.
3. 60 per cent quieter aircraft.
4. Chance of operating new routes, boosting territorial cohesion.



Air Nostrum's turboprop fleet to a zero-emissions setup

**Technical feasibility study of hydrogen technology in aviation:** In June 2021, Air Nostrum signed an agreement with Universal Hydrogen to drive forward its hydrogen-powered turboprop aircraft in the future. Universal Hydrogen technology offers kits that include a hydrogen fuel cell and an electric engine that replaces the existing engine in ATR aircraft. The switchover of Air Nostrum's turboprop fleet to a zero-emissions setup driven by Universal Hydrogen would be completed after a design and performance operational evaluation. Aircraft are expected to have equal or better efficiency compared to the existing fleet.

In addition, hydrogen is an evident solution for decarbonisation because it is green and does not require further offsetting. As regards weight, it is the most efficient energy source and allows acceptable flight ranges for operating at a regional level. Another feature is that it does not require additional infrastructure, either at the airport or during transport.

**Airlander 10 Project:** In March 2021, Hybrid Air Vehicles and Air Nostrum entered into an agreement to assess if airship technology would be a good fit for Air Nostrum's fleet. The project is currently under development and is expected to operate in 2025 or 2026. The main goal is to incorporate the hybrid airship engine into Air Nostrum's aircraft fleet, which will result in a 90 per cent reduction in CO<sub>2</sub> emissions.

### Sustainable aviation fuel (SAF)

In May 2021, Air Nostrum conducted a test flight using SAF from Seville to Valencia. In that flight, 53 litres of SAF were added to the fuel mixture, resulting in savings of more than 100kg of CO<sub>2</sub> emissions. It was the first Air Nostrum flight operated with this type of fuel, which shows a commitment to more sustainable flights.

In line with the Ff55 package, Air Nostrum is committed to a 10 per cent of SAF use in its operations by 2030, exceeding the European Commission's proposed target.

To this end, it will work hand in hand with manufacturers and distributors trying to enter into collaborative agreements that will make it possible to advance the development of biofuels.



Air Nostrum is committed to a 10 per cent of SAF use in its operations by 2030

### Market-based mechanisms (MBMs)

Every year, the company checks its CO<sub>2</sub> emissions tracking and reporting system in its intra-European flight operations, as an important part of the company's environmental sustainability strategy. Air Nostrum's network is predominantly made up by domestic and intra-European flights. In 2019, only five destinations were outside the EU and North Africa (ALG, ORN, CMN, TNG and FNC).

In compliance with the EU ETS, UK ETS and CORSIA requirements, Air Nostrum has implemented an EMP (Emissions Monitoring Plan) that compiles all data and procedures related to fuel and emissions resulting from fuel consumption (aircraft register, completeness of flights, flight recordings, checking of fuel delivery notes, flight clearance and tracking in AIMS, and data extraction).

The verification report containing the CO<sub>2</sub> emissions declaration is submitted every year in February. In addition, the verification body conducts an annual audit reviewing procedures, information, and the final report.

### Air traffic management (ATM)

Satellite-based vertical approaches: Air Nostrum's 100-seat aircraft fleet has received operational approval for vertically guided GPS approaches, without the need for ground support, using Localiser Performance with Vertical Guidance (LPV) and Lateral Navigation / Vertical Navigation (LNAV/VNAV).



Optimising flight plans and improving efficiency through digitalisation

The CRJ aircraft fleet accounts for 51 per cent of the Air Nostrum-operated fleet, but in line with the continuous improvement in environmental performance, the company is considering using both navigation systems in its turboprop fleet of 11 ATR aircraft as well.

The incorporation of these systems will reduce the environmental impact of ATR-operated flights. The VNAV system alone would allow an average estimated savings of two minutes per flight and 20kg of fuel, further optimising flight plans and improving the efficiency and comfort of the crew.

### Digitalisation

Digitalisation of pilot support: In 2018, it was decided to remove any printed documentation used by pilots in the CRJ fleet and replace it with digital tablets. Thanks to this initiative, it has been possible to reduce the weight of the aircraft by about 30kg on each flight, which means a reduction of more than 466tn CO<sub>2</sub>. Following this success, now the focus is on implementing this in the ATR fleet, which is scheduled for 2022. The introduction of the electronic flight bag (EFB) has also resulted in weight reduction on board. Weight has continued to drop thanks to the built-in digital entertainment services, which have eliminated the tourist-class newspapers load, offering passengers a wide variety of multimedia content.

Digitalisation of maintenance tasks: The project to eliminate paper documentation in maintenance activities has been fully implemented. It aims to provide mechanics with individual tablets with eMobility software for recording their daily tasks and checking manuals. It is estimated that up to 24,000kg of paper can be saved. This software allows staff to work using iPad tablets and web applications through two applications that manage the entire maintenance process, including task assignment and distribution; they can also be used to interact with customers and authorise transactions.

### Energy efficiency

SkyBreathe Project: In 2022, Air Nostrum will deploy SkyBreathe, a big data analysis tool. SkyBreathe shows where, at what stage of the flight, and with which aircraft more fuel can be saved.

This initiative aims to:

1. Reduce fuel cost.
2. Increase the efficiency of operations.
3. Quantify and increase fuel savings.
4. Improve fleet performance.

Enhancing the energy and water efficiency at the facilities: The following measures will be taken to improve energy efficiency at all Air Nostrum facilities:

- Installation of photovoltaic systems on the roof of the headquarters building to avoid the emission of approximately 550tn CO<sub>2</sub> per year.
- Consumption monitoring equipment will be installed for a more rational use of electricity, with a potential reduction of five per cent in electricity consumption.
- Presence and motion detectors will be installed in common areas to save 58 per cent in electricity consumption.

Air Nostrum has already replaced the hangar floodlights, the company's main source of electricity consumption, with LED luminaires that have reduced electricity consumption, resulted in economic savings, and reduced the carbon footprint of the maintenance hangar.

This solution will be also rolled out in the other offices of the Valencia headquarters, so that Air Nostrum's facilities have the latest technology available in efficient lighting, with estimated lighting savings of 52 per cent.

Vehicle electrification: Air Nostrum proposed and looked at replacing its fleet of vehicles used at the headquarters with electric vehicles. The savings achieved by this type of hybrid



motor vehicle compared to industrial fleets with conventional engines are in the range of 20 per cent to 30 per cent.

### Circular economy and waste management

Initiative on flights without single plastic use on board: Air Nostrum has begun its transition to plastic-free flights. A pilot test was conducted in 2019 and the goal is to implement this on all flights by 2025.

Reduction of single-use plastic materials in offices: In line with the goal of minimising plastic waste, management provided each employee with a personalised cup in order to reduce the use of plastic cups in the workplace. The president enclosed a letter encouraging staff to continue working together for the environment. Plastic cups were also removed from water dispensers, saving 390,000 plastic cups a year.

Onboard waste sorting: In the case of non-hazardous waste generated onboard the aircraft, work has been done in collaboration with front-line staff to develop a practical and operational garbage cart to put in place flight waste separation policies. Flight crew and airports have participated in the project, as it has been necessary to involve cleaning services to ensure that the waste ends up in the right place.

### Offsetting

Reforestation: Since 2004, Air Nostrum has organised 17 days of manual reforestation helping to restore areas of the Valencian community, such as the Calderona mountain range. In total, more than 6,500 trees have been planted, compensating for 2,344tn of CO<sub>2</sub>.

## AMELIA

In November 2021, the French regional airline Amelia launched an internal pledge to actively find sustainable options to decrease its carbon output; project 'Amelia Green', and created a dedicated team within their strategy department. Focussing on the transformation of the airline towards a sustainable and green company, Amelia Green's mission is to scout, compare and select sustainable solutions for their operations.



Transforming air operations is an incremental and challenging project. Amelia decided to exclude no technology and to invest time and resources in a patchwork of projects, each with their own timeframe and product offering.

To achieve this, the Group has gathered their initiatives in three segments:

1. Current operations optimisation: based on deep data analysis, they try to optimise the existing operational tool

with an intelligent use of all the data collected (better flight paths in particular).

2. Upgrade of the operations with accessible technology and in particular the use of SAFs: SAFs are a cleaner substitute for fossil fuels. This drop-in fuel allows the airline to transition to greener flying without having to change the power system of the aircraft.
3. Technological breakthroughs: electric aircraft, hydrogen (fuel cell, propulsion), hybrids, and so on.

The third component, technological breakthrough, is the priority of Amelia Green and its main focus. Indeed, as innovations in aviation develop incrementally, regional aviation should be the first market to benefit from new technologies, especially new power units. Amelia believes it is the responsibility of the airlines to come forward and help those currently building tomorrow's propulsion systems and aircraft.

Amelia Green has already initiated strong actions. On 10 November 2021 the Group signed the 'Target True Zero' commitment of the World Economic Forum. For the first time, an international coalition of 20 airlines committed to developing electric and hydrogen aircraft by 2030. And Amelia is one of them. This year, two strong partnerships have been announced: the first with Universal Hydrogen, the second with Thales.



Universal Hydrogen – the company leading the fight to decarbonise aviation through the adoption of hydrogen as a universal fuel – and Amelia announced in February 2022 they had signed a letter of intent (LOI) for three ATR 72-600 hydrogen conversion kits.

Amelia is leading the hydrogen transition in France, and is Universal Hydrogen's first France-based airline customer. Following the installation of the conversion kits, Universal Hydrogen and Amelia will enter a contract for Universal Hydrogen to provide sufficient hydrogen fuel to power Amelia's ATR fleet on an ongoing basis.

Of course, and beforehand, to meet these objectives and to be consistent in the approach, the Group has also initiated a global analysis of its activity. Amelia launched an extensive internal audit with the help of Time to Fly in order to establish a carbon footprint for its entire value chain. The foundations of the Group's low-carbon strategy have been laid.



With Iceland as its hub and home, the heart of Icelandair's business model is its international route network and the unique

location of Iceland which serves as a connecting hub between Europe and North America.

In 2021, the regional operations of Air Iceland Connect were integrated into Icelandair's route network. After the integration, Icelandair serves four markets – to, from, via and within Iceland – and also runs both cargo and aircraft leasing services that complement and further strengthen its core network operations. Icelandair's regional services are still operated under the Flugfélag Íslands AOC, which now serves as capacity provider. Flugfélag Íslands' sustainability goals are fully aligned with Icelandair's strategy and targets.

Icelandair recognises the significant impact aviation has on the environment, in particular through carbon emissions. Our [Environmental Policy](#) is the company statement regarding achieving improved environmental performance. We are committed to using all available measures to reduce our carbon emissions, raising awareness about climate issues and being actively involved in industry-wide measures, technical developments and other activities that work towards reducing emissions from aviation. While the primary goal is to reduce total emissions, carbon offsetting is an important additional measure to reach our overall objectives.

In addition to comply with all relevant legal requirements and other obligations, we are committed to:

- Reducing carbon emissions from aviation and other operations.
- Decreasing waste, maximising recycling and finding circular solutions.
- Promoting responsible use of resources.
- Increasing the use of environmentally friendly products and services.

We continually assess and manage our environmental impacts and are committed to supporting continuous improvements by setting measurable targets and benchmarking our performance.

The company is certified to the highest level of IATA (the International Air Transport Association) [Environmental Assessment programme](#) (IEnvA), which requires demonstration of ongoing environmental performance improvements. The IEnvA programme uses environmental standards and promotes best practices in the aviation sector. These are based on recognised environmental management system principles such as ISO 14001. Assessments are conducted by accredited independent organisations with competencies in aviation and environmental auditing.



As stated in the [IEnvA Registry](#) we have successfully completed an independent Stage 2 IEnvA assessment with an expiration date of 1 August 2023. IEnvA Stage 2 Standards represent the highest level of IEnvA compliance and require an airline to

demonstrate ongoing environmental performance improvement. As part of the certification process, Icelandair has mapped all its environmental aspects and their impacts. Aspects that have a significant impact on the environment are managed with environmental management plans which include an overall objective in reducing the environmental impact. All of Icelandair's environmental management plans are aligned with the overall sustainability goals of the company.

Icelandair supports the United Nations' Sustainable Development Goals and have chosen four of them as our strategic focus. As we deepen our understanding of our influences and impacts in terms of sustainability, we continue to align the chosen key focus areas into our organisation's activities by defining relevant projects, indicators and targets.



### Decent work and economic growth

With a focus on promoting policies to support job creation and growing enterprises, as the leading airline and an important employer, and to promote beneficial and sustainable tourism.

#### Goals:

- Measures to evaluate the economic and social impact of Icelandair have been defined and external assessments reviewed (2023).

### Gender equality

With a focus on the gender ratio at the management level, among pilots, cabin crew and maintenance roles to work towards a more equal gender representation.

#### Goals:

- Never less than 40 per cent of either gender in management positions (2025).
- Increase the number of female pilot positions by 25 per cent (2025).
- Increase the number of male cabin crew positions by 25 per cent (2025).
- Increase the number of female aircraft maintenance by promoting the job and education to girls (2023).

After the recent hires at Icelandair's regional services for the summer of 2022, 13 per cent of pilots are female, well above the industry average of five per cent.

### Responsible consumption and production

With a focus on our operation to promote sustainable procurement practices, and substantially reduce waste generation.

#### Goals:

- Integrate Icelandair's Supplier Code of Conduct in 50 per cent business contracts (2023).

- Perform and register risk assessment on all new signed and renewed contracts (2023).

### Climate action

With a focus on our flight operations and ground vehicles to ensure that the company does all it can to limit its climate impact.

#### Goals:

- 50 per cent reduction in net emissions per operational tonne kilometre (OTK) compared to 2019 (2030).
- Net zero emissions from flight operations (2050).
- 40 per cent reduction of emissions from ground vehicles compared to 2019 (2025).

These goals represent the areas where the company considers it can have the most impact and best create shared value, and thereby contribute to a more sustainable future.

### The energy transition in aviation

The biggest impact Icelandair can have, is to lead the energy transition of aviation in Iceland.

In 2021, the company signed [two declarations](#) of intent to explore emerging technologies in hydrogen and electric-powered aircraft. The former with Universal Hydrogen, which has designed energy exchange equipment that enables Icelandair to turn the company's Dash-8s into hydrogen-powered aircraft. The second is with Heart Aerospace, which is working on developing passenger aircraft powered by electricity. Short routes and easy access to electricity from renewable sources place Iceland in a vital position in terms of energy exchange in domestic flights. The projects also fit well with the government's policy framework for the future of tourism, which aims to make Iceland a leader in sustainability.

The company recently began a collaboration with Landsvirkjun, the national power company of Iceland, to accelerate the energy transition in aviation. The agreement is for two years, and the first goal is to evaluate the possibilities of a development project where first steps in energy transition would be taken. For example, this could include projects on the use of sustainable fuel, green hydrogen, or electricity as energy carriers for aviation in Iceland. The second goal is to create a venue for stakeholders and promote co-operation on the energy transition in aviation, and thirdly, to educate both stakeholders and the general public about the importance of energy transition and what steps need to be taken.

The company is in a unique position to be at the forefront when it comes to energy transition in aviation, starting with Iceland. This is because of short domestic flight routes and ample access to green energy. Furthermore, as the technology advances, Iceland's location between Europe and North America could create exciting opportunities when it comes to the energy transition of transatlantic flights.



KLM Cityhopper's sustainability targets and results must be seen in the broader context of the Air France–KLM (AFKL) strategy and targets. Early in 2022, KLM renewed the company's purpose and strategy, being defined as 'pioneering sustainable aviation'. KLM does not merely want to transform its own company into a sustainable one, but wants to use its position and take a leading role in the aviation industry.

Being a subsidiary airline within KLM, the Group's targets and initiatives also apply to KLM Cityhopper. In addition to that, KLM

Cityhopper has its own roadmap to accelerate the decarbonisation of its operations.

### Science-based targets

In November 2021, KLM committed itself to the Science Based Targets initiative (SBTi). By this commitment, the climate ambitions for 2030 are in line with climate science based on the SBTi guidelines for aviation. This concerns the CO<sub>2</sub> emission targets compared to 2019. By using the SBTi, CO<sub>2</sub> emissions can be reduced step-by-step in a transparent manner.

KLM has set the target to reduce CO<sub>2</sub> emissions by 50 per cent per passenger kilometre by 2030 compared to 2005. To achieve this ambition, we focus on fleet modernisation, improving operational efficiency, and promoting and using SAF and carbon offsetting. The target for zero-emission ground operations by 2030 is set together with the Dutch Government.

### Fleet modernisation

The most impactful way to reduce the carbon footprint is to invest in a more fuel-efficient fleet. From late 2023, new A320neo/A321neo aircraft will begin replacing KLM's existing Boeing 737 NG aircraft on European routes. The replacement of the long-haul and cargo fleet is accelerated. KLM Cityhopper added the first 12 of 25 new Embraer 195-E2 aircraft to its fleet. This aircraft emits 31 per cent less CO<sub>2</sub> per passenger than its predecessor.

Looking further ahead, KLM is actively involved in research into future aircraft design in corporation with TU Delft. The Flying-V is a design for a very energy-efficient long-haul aircraft. The improved aerodynamic shape and reduced weight of the aircraft will reduce fuel consumption by 20 per cent compared to today's most advanced aircraft.

### Operational efficiency

By analysing flight performance, KLM aims to reduce fuel use through various projects, focussing on: fuel policies, fuel standards, accurate planning information, route optimisation and weight reduction.

Innovations in all areas of maintenance to improve aircraft performance have been implemented. This includes the engine water wash and the washing of the aircraft exterior to optimise aerodynamics, and engine removal cycles.

KLM is proactively involved in the SESAR programme, which contributes to the targets of the Single European Sky (SES) directed at better management of air traffic. SESAR aims to contribute to the SES 10 per cent CO<sub>2</sub> reduction target.

### SAF and CO2ZERO

Use of SAF is one of the most impactful measures for reducing CO<sub>2</sub> emissions from aviation. KLM has purchased SAF for flights out of Amsterdam Airport Schiphol. This sustainable fuel produced from used cooking oil will bridge the gap until the coming onstream of the SAF production plant. In January 2022, KLM Group started with the standard addition of 0.5 per cent SAF on all outbound flights from Amsterdam Airport Schiphol.

KLM's compensation service CO2ZERO enables passengers to offset their carbon emissions. Customer contributions are invested directly in a carbon-offsetting project in Panama certified by the Gold Standard for the Global Goals label that focusses on planting new trees, preserving existing forests and supporting the local community.

### Fairline programme

KLM Cityhopper launched the Fairline programme, which has the ultimate goal to become a climate neutral airline by 2028 and



act as an accelerator for the KLM Group. The programme puts sustainability in a central role in the strategy and facilitates a wide range of initiatives aiming to contribute to multiple sustainable development goals (SDGs).



KLM Cityhopper's new Embraer 195-E2

As part of the programme, KLM Cityhopper participated in the SkyTeam Sustainable Flight Challenge in May 2022. In this challenge all SkyTeam airlines compete to execute their most sustainable flight ever, aiming to push innovation in the industry and learn by knowledge sharing. Achievements on this flight included the use of 39 per cent SAF, fully electric turnaround and an optimised flight plan, including contrail avoidance.

The Fairline programme has a broader approach to sustainability like waste reduction, people sustainability, economic and social value, noise reduction and non-CO<sub>2</sub> effects. Impact is increased by creating partnerships with suppliers and knowledge institutions.



## Corporate initiatives

### Azores Airlines' fleet renewal

In 2021, Azores Airlines received a new Airbus A321neo LR, with the registration CS-TSJ. This aircraft was the fifth aircraft from the A321neo family and represents 63 per cent of the fleet that has been renewed since 2018. These aircraft, with state-of-the-art engines and on-board sharklet wings, reduce fuel consumption by around 37 per cent which is relevant to the carbon footprint of each passenger, when compared with previous aircraft. The Azores Airlines' fleet renewal process, which began in 2018, estimates a total annual reduction of 13,200tn CO<sub>2</sub> upon conclusion, which is an important investment in improving the quality of service in line with sustainability commitments.

### Electronic flight bag (EFB)

Azores Airlines has implemented the EFB, which involves replacing mandatory paper flight manuals with a digital solution (Fly smart +) that guarantees the updating of all on-board manuals and optimises the calculation of the aircraft's performance. **This technology allows, at the end of each**

**year, reduced fuel consumption of 50tn and consequently a reduction of 165,500kg CO<sub>2</sub> emissions into the atmosphere. It also eliminated the printing of around 500,000 sheets of A4 paper.** This evolution with an impact on environmental improvement represents a commitment in line with the strategy sketched by our Group.

### Plastic reduction on board

With the aim of reducing plastic on board, the SATA Group presented more sustainable alternatives and, in 2021, around 1,450,000 individual plastic items from the onboard operation were replaced, namely plastic coffee straws, plastic cups and bags of plastic cutlery to paper and wood respectively.

### Other measures with an impact on reducing environmental footprint:

#### Operational measures

Operational measures are actions with an impact on the direct reduction of fuel consumption and CO<sub>2</sub> emissions, which are one of the strategies for achieving carbon neutralisation in aviation.

SATA Air Açores has implemented a set of good operational practices (delay engine start; only single engine taxi in/out; cruise climb and long range cruise technic; flight data monitoring – FDM; and EFB) that promote fuel savings in different stages of the flight, with expressive results in the global totalling of the air operation. **The implementation of these types of measures represents an average annual fuel saving of 21 per cent in the Dash 8 Q400 fleet and 26 per cent in the Dash 8 Q200 fleet, equivalent to around 900tn/year.**

Azores Airlines has implemented the Dynamic Efficiency Project, in line with Airbus's Green Operating Procedures (take off with air conditioning packs Off; Datalink CPDLC and the reduction of APU use).

### Carbon offsetting

SATA Group's offset carbon emissions from air operations are reported to the regulatory programmes, namely CELE (European Emissions Trading) and CORSIA.

In 2021, Grupo SATA participated in phase IV (2021–2030) of the ETS programme, contributing to the achievement of the objective of a 40 per cent reduction in GHGs by 2030 (based on the year 1990). It should be noted that flights between EU Member States and the remotest regions of another European Member State, as well as flights covered by the public service obligation, are excluded from the ETS rule.

CORSIA, developed by the International Civil Aviation Organization (ICAO), aims to offset the growth of CO<sub>2</sub> emissions in international air traffic. This rule will run from 2021 until 2035 and will consist of three phases. Grupo SATA is currently in the pilot phase (2021–2023), where it reports emissions from routes covered by the rules.

### Electric ground support equipment (GSE) used in handling

Handling operating equipment is gradually being replaced by electric units (baggage tractors, forklifts, ladders, baggage walkways). In 2021, two electric luggage conveyors were acquired. **Currently, 26 per cent of SATA Air Açores' GSE is electric, with an impact on fuel reduction of around 123,300 litres per year.**

### Buildings – decarbonisation

The energy efficiency of buildings improves energy performance and indoor air quality, with environmental and economic benefits. The energy certification process is underway at Azores

aerodromes, in compliance with the European regulation on the Energy Certification System for Buildings. Regarding fluorescent lamps, pilot projects are being prepared for the installation of LED technology. Preference is given to the purchase of electrical electronic equipment (EEEs) with a better energy rating. To improve the availability and control of drinking water, water reservoirs were built at the São Jorge and Graciosa aerodromes.

### Digitisation

Digital solutions are often seen as solutions to address the environmental, economic and social challenges we face today. At SATA Group, in addition to the EFB, other actions which have a great impact on reducing paper have been developed:

- Reformulation of the **system for issuing boarding passes in order to print two segments**.
- **Availability of the in-flight magazine in digital format.** This measure made it possible to avoid printing 13,200kg of paper, corresponding to an estimated annual savings of 63,000kg CO<sub>2</sub> in Azores Airlines' air operation.
- Use of electronic platforms **for digital signatures (DocuSign)**.

### Waste management

Residues that came from maintenance operations are separated, duly packaged according to hazard classification and subsequently sent for recovery, accompanied by an electronic waste monitoring guide. For waste produced in the offices, a temporary storage area was created in the headquarters building, facilitating the separation of larger waste and of various types.

To ensure the correct management of waste in works created by SATA, Prevention and Management of Construction Plans and Demolition Waste and Environmental Management Plans are prepared and analysed.

### Retreading aircraft tyres

At SATA Air Açores, aircraft tyres are retreaded, which is a continuous process and has led to a lower environmental and economic impact. Used tyres are packed in rows, containerised and sent to a retreading operator, which ensures compliance with the approval requirements of our industry. Each tyre has a three-year cycle, representing a substantial reduction in the purchase of new tyres, and in the reduction of waste. Since 2015, when this process was implemented, up to the end of 2021, 1,581 tyres have been retreaded. We must highlight, that the difference in tyre consumption varies according to the number of landings, aircraft weight, weather conditions, among other factors.

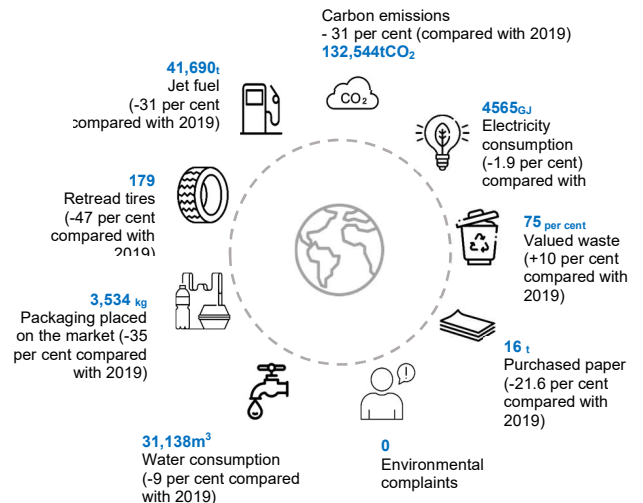
### Animal preservation

As a measure to prevent bird strikes at the aerodromes of the Azores and to preserve native species, a biannual analysis of the presence of animal life is carried out at the airfields of Graciosa, São Jorge, Pico and Corvo. Visual checks are also carried out on the runway perimeter, with the activation of sound signals to remove birds before aircraft land.

### Communication and reporting

Operational indicators are disclosed in annual reports, in the organisation's internal channels (mysata, Ibelong and the internal blog). Also, we use those channels to publish articles referring to sustainability questions. The legal and regulatory requirements applicable to the organisation are controlled and complied with, as is the submission of mandatory reports.

### 2021 at a glance...



In 2020, SKY express incorporated the highest environmental standards regarding air emissions, noise pollution and ground operations in its developmental strategy. Moreover, the company follows European and international climate trends in the sector to improve its performance, and participates in relevant national and European consultations in order to form the sustainable future of aviation.

As for the first two components (air emissions and noise) the company started implementing the strategic target of **fleet renewal** in 2020, which is ongoing in 2022. Moreover, on air emissions, the company introduced a wide range of continuous actions, such as: new **route optimisation plans**, **aircraft weight reduction** measures and implementation of revised **policies for optimising fuel consumption** resulting in reduced CO<sub>2</sub> emissions. As for ground operations, in view of the arrival of new aircraft, SKY express performed a total renovation of the company's warehouse and also updated the warehouse's storage protocols and record-keeping procedures. The company also was recertified (in 2022) for its environmental performance and continues to hold the ISO 14001 certification. Additionally, SKY express on the ground consumes electric power produced from renewable energy sources (RES) accompanied by green certificates.

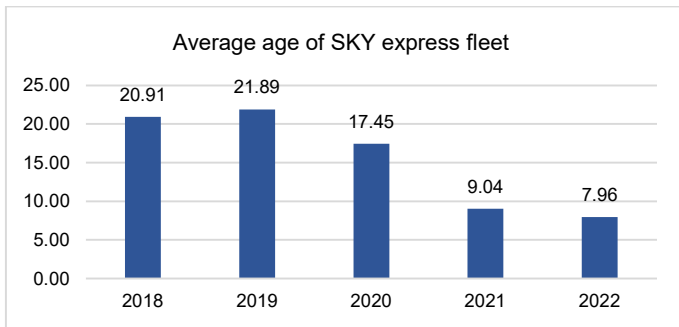
### Reduction of GHG emissions

Emission reduction is based on the following three areas:

1. fleet modernisation;
2. green operational procedures; and
3. aircraft weight reduction.

### Fleet modernisation

As already mentioned, SKY express incorporated the highest environmental standards in the company's developmental strategy. One of the strategy's environmental targets is the renewal of the fleet (which continues during 2022). The evolution of the fleet age is depicted in the following figure:



The drastic reduction of the fleet average age is also accompanied by expansion of the fleet and the list of destinations SKY express operates, which is in line with company's economic strategic targets. With the new A320neo in the fleet, SKY express is the fastest-growing operator in Greece, manifesting the company's devotion to fighting climate change.

The new LEAP-1A engine option from CFM International creates one of the world's most advanced and fuel-efficient single-aisle aircraft family. All of the A320neo aircraft have large, fuel-saving wingtip devices (sharklets). These 2.4 metre-tall wingtip devices are standard on neo aircraft, and result in up to four per cent reduced fuel burn over longer sectors, corresponding to an annual reduction in CO<sub>2</sub> emissions of around 900tn per aircraft. Additionally, SKY express optimised the cabin space in the A320neo by taking advantage of the increased exit limits, to accommodate 174 and 186 passengers, in two classes of density configuration, so as to become more efficient in terms of tonnes-kilometre (TKMs) carried per route.<sup>12</sup> Moreover, SKY express acquired six new ATR 72-600 aircraft in 2021 with turboprop technology, which are highly efficient and tend to operate at lower speeds, making ATR 72-600 the most fuel-efficient aircraft in their category according to the manufacturer. The ATR 72-600 has an excellent landing and take-off performance, giving pilots the ability to use shorter runways, therefore reducing air traffic congestion and decreasing fuel consumption.<sup>13</sup>

### Green operations

Taking into account our efficient and young fleet, we initiated the 'Green Fleet means Green Ops' operational procedures, thus escalating the fight against climate change. The measures in our Green Operations Manual include, among others, guidance for: optimum take-off configuration; optimum take-off thrust; minimising APU usage via preliminary cockpit preparation and maximising ground power unit (GPU) use after landing and at the parking position; determining optimum cost index; air conditioning setup during taxi; take off and flight; optimum landing procedures based in thrust management; single engine taxi out along with continuous climb and descent operations (CCO/CDO). Additionally, regarding route optimisation, SKY express acquired NAV BLUE, the flight planning system software designed specifically for the A320neo, to refine route planning.

On top of this, SKY express continues to apply all potential measures to reduce taxi time when permitted by ATC for both its ATR aircraft and A320neos, meaning less taxi time and lower air emissions. SKY express continues to perform visual departure for ATRs in 2022 when visual meteorological conditions apply, to minimise engine track miles and time in aprons, which further contribute to reduced air emissions.

<sup>12</sup> The environmental performance of A320neo is publicly available here: <https://www.airbus.com/aircraft/passenger-aircraft/a320-family/a320neo.html>.

### Aircraft weight reduction

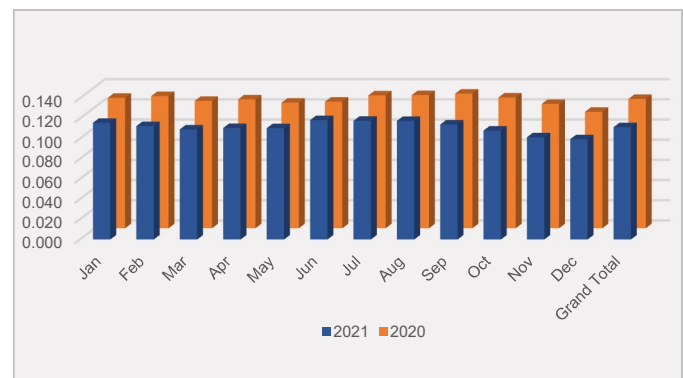
SKY express has revised all internal processes in the light of the European Green Deal and the collective efforts to become the first climate-neutral continent and economy by 2050. In this view, weight reduction policies are incorporated in operational procedures. These resulted to the following actions:

1. Removal of printed manuals from all flights by substituting those with electronic versions.
2. Lighter trolleys replaced old ones on all aircraft, while the new A320neo are equipped with lighter seats.
3. An algorithm is used in order to calculate the necessary quantity of drinkable water per flight.
4. Gradual replacement of carpets with ultra-light eco-friendly ones.
5. Implementing a new, more efficient refuel/tankering policy in order to minimise both fuel consumption and emissions due to optimum fuel carriage.

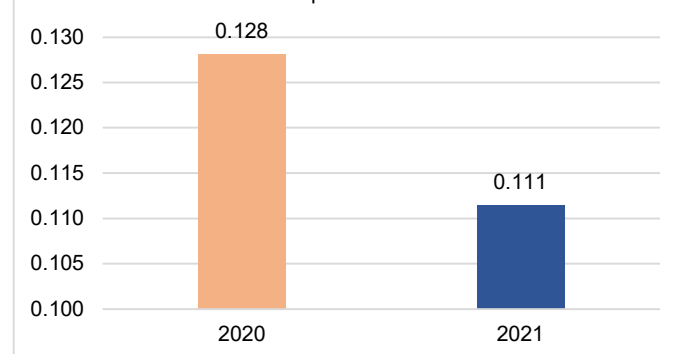
### Monitoring the reduced emissions

SKY express developed a detailed monitoring plan based on key performance indicators (KPIs) regarding the reduction of air emissions in order to monitor the effectiveness of the relevant measures, since some of those may require modification and enforcement actions. Below is presented the reduction of air emissions per available seat kilometre (ASK) from 2020 (0.128kg CO<sub>2</sub> per ASK) to 2021 (0.111kg CO<sub>2</sub> per ASK), which is equal to 13.2 per cent.

Evolution and comparison of CO<sub>2</sub> (kg) per ASK and per month for 2020 and 2021



Air emission reductions from 2020 to 2021: CO<sub>2</sub> (kg) per ASK



### Noise reduction

SKY express, as a regional airline flying in small airports all over Greece, is sensitive and pays a great deal of attention to noise emissions and compliance noise levels (dB contours) set in environmental licenses for each airport. The new A320neo aircraft offer significant improvements in environmental

<sup>13</sup> The environmental performance of ATR 72-600 is publicly available here: <https://www.atr-aircraft.com/our-aircraft/aircraft-family/>.



performance with significant noise reduction. Also, ATR aircraft have low cumulative noise emission. Additionally, the company's Flight Standards department has engineered new procedures for landing and take-offs resulting in lower noise emissions.

### Market-based measures and policy actions

SKY express is actively involved in policymaking, directly or through collective bodies (such as ERA), regarding market-based climate instruments including the EU ETS and CORSIA. SKY express participated in the public consultation 'EU emissions trading system – updated rules for aviation' held by the EC during 2020. SKY express supports the decarbonisation of the aviation sector through the company's involvement in the ERA initiative, Destination 2050, and by the signing of the Toulouse Declaration.

### Ground operations

SKY express started to consume electricity with green certificates during 2020 (and still does) for office and warehouse needs, reducing the carbon footprint of ground operations.

The airline's new fleet requires new maintenance skills, for which SKY express provides continued training for the company's engineers. In addition, the warehouse renewed the recording mechanism of all chemicals (new and old materials necessary for maintenance) in order for the registry to produce more accurate data and signalling new orders faster. This was reflected in our recertification with ISO 14001 in August 2022.

In 2021, SKY express started using the JotForm platform reducing printed forms and reports to minimise the company's environmental footprint.

### Sustainable aviation fuels (SAFs)

SKY express is dedicated to the highest environmental standards and supports the fight against climate change. Since these two notions are integrated into the company's developing strategy, our strategic climate goals are under revision in order to include adequate SAF usage in terms of minimising our climate impact towards 2050. SKY express plans to continue renewing its fleet in the coming years in parallel with escalating SAF use, in order to ensure that our strategic climate goals will become the company's comparative advantage against European and international competition.

## Collins Aerospace

### Working to decarbonise aviation

At Collins Aerospace, we believe that sustainability isn't a choice – it's an imperative. Quite simply, we must all do our part to reduce our environmental impact. And it's not just a priority for us, but for all our stakeholders as well, including our customers, our employees, our shareholders, our regulators and the flying public.

As a leader in technologically advanced and intelligent solutions for the global aerospace and defence industry, we are in a unique position to make a positive impact on the future. Our resources, knowledge and experience give us a greater grasp of the challenges ahead – and above. This is a once-in-a-lifetime opportunity to transform air travel as we've known it.

Collins has committed to support the aviation industry's goal of net zero carbon emissions by 2050 as part of the declaration released by the Air Transport Action Group (ATAG). In 2019, we signed the Clean Sky 2 Joint Declaration of European Aviation Research Stakeholders to lead the way toward the

decarbonisation of aviation by 2050. And in 2021, we signed the letter of intent to join as a founding member of the currently forming Clean Aviation Joint Undertaking. Collins is also a founding member of the International Aerospace Environmental Group (IAEG) and, together with Airbus, leads the organisation's Work Group 11 that is focussed on aerospace industry ESG engagement. In addition, Collins is working to support a greener economy in Europe through our membership in AmCham EU.

Collins' annual research and development exceeds €2.9bn, the vast majority of which supports technologies that drive improved sustainability. To support the aviation industry's goal of net zero carbon emissions by 2050, we have several initiatives underway to advance enabling technologies as part of our sustainability technology roadmap, including the following:

- **Connected ecosystem** – Creating more connected solutions for aircraft that use real-time data and predictive technologies to optimise flight routes and use less fuel, and developing artificial intelligence-based flight optimisation and aircraft routing tools that leverage airspace information, atmospheric data, aircraft state and performance databases for dynamic route optimisation. Our recent [acquisition of FlightAware](#), which we combined with our Information Management Services division to form our new Connected Aviation Solutions business unit, has enhanced our ability to improve route efficiency and reduce the carbon footprint of air travel even further.
- **Alternative power sources** – Working together with our sister Raytheon business, Pratt & Whitney and the Raytheon Technologies Research Center, we are supporting the development of hybrid-electric and all-electric propulsion systems. At the same time, we are designing more electric aircraft systems to replace traditional hydraulic and pneumatic systems, thus reducing greenhouse gas emissions. And we're bringing new systems on board aircraft that can accommodate sustainable aviation fuel.
- **Advanced structures** – Creating lighter, streamlined and more fuel-efficient architectures for aerostructures by using technologies that include thin acoustic structures, low-drag liners and environmentally friendly coatings to reduce drag.
- **Integrated solutions** – Our breadth of tip-to-tail solutions provides us with unique opportunities to combine systems across our portfolio. For example:
  - **Integrated aircraft doors** – Smaller and lighter one-piece door structures for a more efficient use of space on the aircraft.
  - **Power thermal management solutions** – In collaboration with Pratt & Whitney and the Raytheon Technologies Research Center, we paired advanced systems architectures with digital engine controls in new ways to increase vehicle thermal capabilities, reduce fuel burn, and lighten overall aircraft weight – all while optimising engine performance.



With thermoplastic composites, the weight of aircraft could be potentially reduced by 20 to 50 per cent

## Sustainability efforts in Europe

Collins has a significant European footprint and, consequently, many of our decarbonisation initiatives are rooted there. For example, in November, we [acquired Dutch Thermoplastic Components \(DTC\)](#), a leader in the development and fabrication of structural thermoplastic composite parts. By acquiring DTC, we expanded our ability to use advanced thermoplastics to make lighter aircraft components for our customers, ultimately helping support lighter aircraft that are more fuel-efficient. With thermoplastic composites, we can potentially reduce the weight of aircraft structures by 20 to 50 per cent compared to thermoset solutions and metallic solutions respectively.

In addition to improved product performance, thermoplastics are also more sustainable to manufacture. By using traditional materials like thermosets, aircraft parts are cured in large autoclave ovens that consume a massive amount of energy. With thermoplastic composites, we are using more efficient out-of-autoclave processes that greatly reduce energy usage. Switching from thermosets to thermoplastic composites also adds to energy efficiency as cold storage of thermoset materials is eliminated. Thermoplastic composites have higher resistance to impact and fatigue compared to thermosets. This means that parts will last longer, a key to future circular economies. Finally, thermoplastic composite products are fully recyclable at the end of their lifecycle, meaning that they can be melted, reshaped and reused.

As part of our electrified aircraft initiative, we're developing state-of-the-art electric motors for hybrid-electric propulsion systems at our Electronic Controls and Motor Systems Centre of Excellence in Solihull, UK. These systems, which combine fuel-burning engines with electric motors and batteries, can significantly improve aircraft fuel efficiency and lower carbon dioxide emissions, while also reducing noise and operating costs. It is estimated that large commercial and regional aircraft can reduce fuel burn by approximately five per cent and 30 per cent respectively, when implementing hybrid-electric propulsion architectures.

Last summer, Pratt & Whitney Canada (P&WC) [announced](#) plans to integrate new hybrid-electric propulsion technology into a De Havilland Canada Dash 8-100 flight demonstrator. P&WC's fuel-burning engine will be combined with one megawatt electric motor from Collins in a hybrid configuration that will optimise engine performance throughout the different phases of flight and demonstrate potential fuel savings of around 30 per cent.

Collins has also teamed up with UK-based Hybrid Air Vehicles and researchers at the University of Nottingham on the [world's first zero-emission aircraft](#), Airlander 10. To achieve zero-emission operation, Airlander 10's four fuel-burning engines will be replaced by 500kw electric motors provided by Collins. This will happen in a phased approach, beginning with the two forward engines in 2025 to achieve hybrid-electric operation, and the two rear engines in 2030 for zero emissions.

With the support of the French Government and local communities, and in collaboration with local industry, we've also made a significant investment in Collins Propeller Systems in Figeac, France. The centre's mission is to find innovative ways to design and manufacture more sustainable, next-generation propeller systems for turboprop engine-powered aircraft. Whether propeller-enabled engines are burning sustainable fuel or hydrogen in the future or are replaced with electric motors or hybrid-electric systems, propeller aircraft can play a large role in reaching fleet sustainability goals.

With the support of the French civil aviation authority, Direction Générale de l'Aviation Civile (DGAC), Collins Aerospace has also launched a four-year research and development

programme to develop 'smart' actuation components for both commercial airplanes and helicopters. These new technologies will contribute to the development of high-performance, thin-wing designs to enable lighter and more energy efficient aircraft configurations.

Lastly, since 2017, Collins has invested more than €34m in the development of chemical alternatives. For example, we use hexavalent chrome processes on many of our products for wear and corrosion resistance. In response to maturing global Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) regulations, we have qualified and placed into production hexavalent chrome-free alternative processes in our facilities in the EU and UK. These greener alternatives meet and/or exceed material performance of the hexavalent chrome processes being replaced.

In closing, at Collins Aerospace we believe sustainable development is vital – not just to the future of the aviation industry, but to the future of our planet. With more than 100 years of industry-leading innovation experience, we are committed to redefining aerospace by introducing new technologies to support our industry on its path to decarbonise aviation.



Collins Aerospace propeller production centre in Figeac, France.



Thales has set an ambitious roadmap for a low-carbon future and is contributing through its advanced technologies to make the world safer, more environmentally responsible and more inclusive.

### Thales commitments to net zero emissions by 2040

In 2019, Thales set its own targets for the reduction of operational CO<sub>2</sub> emissions, and raised those targets in 2021, aiming to achieve a 35 per cent reduction by 2023, a 50 per cent reduction by 2030, and net zero by 2040. These targets are consistent with the Paris Agreement's objective of limiting global warming to 1.5°. The Group will begin the SBTi (Science-Based Target initiative) certification process to substantiate its progress towards these goals. In addition, the Group expects to adopt eco-design principles for 100 per cent of its new products and services by 2023. Thales will also engage more methodically with suppliers and provide more support for their own efforts to reduce carbon emissions, with 100 per cent of the action plans of the 150 most polluting suppliers approved and launched by 2023, and systematic engagement with suppliers to bring them into line with its goal of cutting emissions by 50 per cent by 2030.

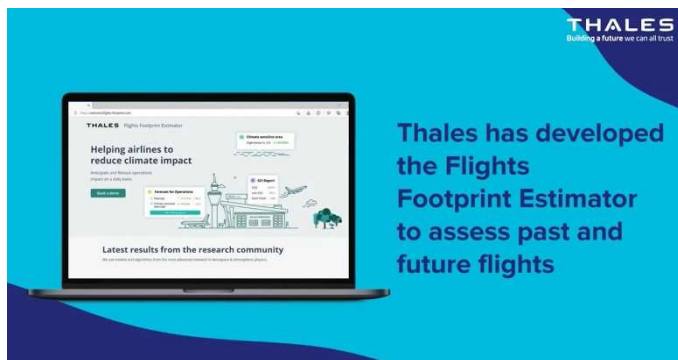
## Thales advanced technologies for greener aviation

In addition to improving aircraft performance; optimising aircraft operations has been identified as a major way to contribute to the objective of halving emissions by 2050. Optimising air transport would reduce CO<sub>2</sub> emissions by 10–15 per cent – or more than 100 million tons of CO<sub>2</sub> – by 2040. As a world leader in Flight Management Systems (FMS) and Air Traffic Management (ATM), Thales is developing flight path optimisation solutions that would reduce aircraft CO<sub>2</sub> emissions by up to 10 per cent in the near-term future. Thales PureFlyt, new generation FMS, draws on both onboard and open-world data, such as weather information. By combining the integrity of the FMS and the agility and power of Electronic Flight Bag functionalities, aircraft trajectory can be permanently controlled, adapted and enhanced, resulting in optimised flight and decreased fuel consumption.

## Eco-friendly flight operations

Thales also develops solutions for eco-friendly flight operations to provide aviation stakeholders with concrete means to improve their carbon footprint and climate impact thanks to its unique assets in avionics and Air Traffic Management. These 'green operations' solutions entail both a measurement tool, Flights Footprint estimator, that enables them to act now, and the experimental concept of enhanced collaboration between Air Traffic Control and airlines to perform low CO<sub>2</sub>eq (CO<sub>2</sub> equivalent) trajectories whenever possible.

Flights Footprint estimator is a web app and a set of APIs to pilot, monitor and reduce the climate impact of any flight all in one digital tool. It estimates and forecasts both CO<sub>2</sub> and non-CO<sub>2</sub> effects. It relies on the capability to forecast climate sensitive areas on a daily basis, in which non-CO<sub>2</sub> effects (NO<sub>x</sub>, persistent contrails) are emphasised. In addition, it provides recommendations to aircraft operators to avoid these areas. The Flights Footprint solution has been awarded the SOLAR IMPULSE label and is part of 1,000 clean and profitable solutions to address sustainability challenges.



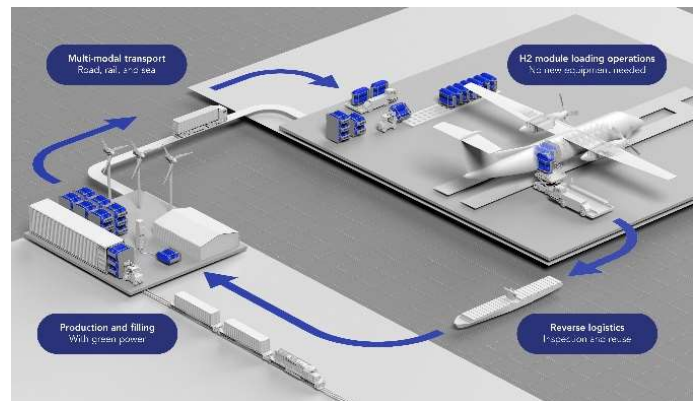
We engage with airlines and aviation professionals to test the Flights Footprint solution and act now. Thales and ERA member airline Amelia worked together to study the airline's flight data, using the Flights Footprint solution to provide an objective impact analysis of the company's operations, as explained by Solenne Regourd, Amelia, VP Sustainability & Network Manager: "The magic of Flights Footprint is that it *takes into account both CO<sub>2</sub> and non-CO<sub>2</sub>*. Using it has allowed us to completely rethink what makes a flight eco-friendly and imagine levers to reduce our environmental impact on the very short term."

## Universal Hydrogen

As an industry, we are proud of aviation being one of the greatest forces of globalisation and commercial and cultural exchange. However, it is also one of the largest sectors without a credible roadmap for reaching the emissions reduction goals of the Paris Agreement. In fact, aviation emissions are set to grow – not decrease – over the coming decades because traffic growth will far outpace efficiency improvements. This is good neither for the future of aviation nor the environment.

The aviation sector has leaned on SAFs such as biofuels and synthetic fuels as the primary approach to reducing net emissions. It is important to recognise, however, that SAFs are at best an offset scheme. They are still hydrocarbons that get burned at 35,000ft, producing both CO<sub>2</sub> and significant non-CO<sub>2</sub> emissions that contribute to global warming.

Why are SAFs foremost on our industry's agenda? Because they require minimal changes to aircraft, jet engines, and on-airport fuel infrastructure. As such, they are an important measure for powering the legacy fleet, particularly larger and longer-range aircraft. For the regional airline fleet however, hydrogen is in many ways the ideal aviation fuel. Hydrogen is truly carbon-free and has an energy per unit mass that is three to four times greater than jet fuel. And green hydrogen – hydrogen produced by breaking water molecules using off-peak renewable electricity – is on track to be cheaper than jet fuel on a per unit energy basis by the mid-2020s.



Hydrogen-powered aviation is not a novel idea. The first crewed hydrogen-powered airplane flew in 1956. The Soviets flew an airliner, the Tupolev Tu-155, on hydrogen in 1988. Regional aircraft can fly on hydrogen with a retrofit of the existing fleet. A modern airliner could achieve transatlantic range with a modest fuselage stretch to accommodate hydrogen storage – a new design, but not a radical one.

The main obstacle to hydrogen adoption in aviation is the lack of hydrogen distribution infrastructure to the world's airports. Building it using conventional approaches is a multi-trillion-dollar, decadal investment on a global scale. We founded Universal Hydrogen to pioneer hydrogen distribution using the existing intermodal freight network, which already extends to nearly every airport in the world. We put hydrogen in lightweight capsules certified to aviation and terrestrial transport safety standards. These capsules can be transported in shipping containers and loaded directly into the aircraft using existing cargo handling equipment. Every airport is hydrogen-ready without infrastructure upgrades.

In order to provide the platform for our hydrogen capsules, we are developing supplemental type certificates (STCs) for a



number of regional aircraft currently in service. The STCs cover the creation of hydrogen storage areas inside the aircraft by removing a couple of seat rows, loading access to these areas, and all the plumbing required to feed the powertrains. These powertrains are developed together with our partners, magniX and PlugPower. Aircraft converted to run on hydrogen enjoy better energy efficiency compared to pre-conversion. This is driven by hydrogen's almost three times higher specific energy compared to Jet A-1, and our powertrain efficiency, which is almost twice that of a traditional turboprop.

In addition to more energy-efficient aircraft, we also expect to see the cost of green hydrogen production to decline steadily over the coming decades, with a pace that should offer operating seat costs comparable to Jet A-1 aircraft of the same type, even with the reduced seat count. Our solution offers a second or potentially third life to airframes, which may be revitalised with our hydrogen-electric powertrains. This enables a low-cost, environmentally friendly extension of airframes well into the next two decades – if not beyond.

Our commitment to providing a carbon-free alternative to aviation is matched by our potential customers' interest in our product, having secured seven publicly announced letters of intent (LOIs) for hydrogen conversion kits for Dash 8-300 and ATR 72 aircraft as of 1 March 2022. As the programme keeps on track, we expect to reach one of our major milestones in 2022, when our Dash 8-300 will take to the skies operating our hydrogen-electric powertrain for the first time.

However, as Universal Hydrogen aims to become the market leader of hydrogen distribution in difficult-to-decarbonise industries, we are steadily ramping up our resources to establish end-to-end value chains for our future customers, parallel to developing the solutions required to decarbonise those industries.



While work has already begun and is well underway on securing the hydrogen value chains, the recent appointment of Jørn Rosenlund as Chief Operating Officer (COO), with his background and experience in hydrogen production and refuelling, will position Universal Hydrogen on a path to firmly establish its position in the hydrogen end-to-end value chain for our customers.

2021 saw Universal Hydrogen cement its name, values, and mission in aviation. We expanded into Europe through our second engineering centre in Toulouse, France where our ATR 72 conversion and liquid hydrogen capsules are being developed. Perhaps most importantly for zero carbon aviation, we secured public and unannounced LOIs from a wide range of regional carriers, with a wide range of operational requirements from multiple continents. This is a true testament that hydrogen is the only true globally feasible zero-carbon alternative to Jet A-1.

In 2022 we aim to build on our strong foundation from last year. Our growing talent pool will enable us to ramp up our work on our products and importantly to transition to an operational mindset. We are determined on our path to deliver the solution for regional operators to eliminate their carbon footprint in a profitable way, with low investment cost requirements and in the near future.



Over the course of the last couple of years, ZeroAvia has advanced expectations about the potential for zero-emission commercial flights operating at scale within this decade. In the process, the company increased its headcount, bolstered its facilities and attracted critical investment for funding its growth plans.

ZeroAvia's R&D work progressed at pace, notably as part of both the HyFlyer I and II projects, both backed by grants from the UK's Department for Business, Energy & Industrial Strategy (BEIS), Innovate UK and the Aerospace Technology Institute. With HyFlyer I, ZeroAvia completed more than 35 test flights of the retrofitted Piper Malibu, continuing on the learnings following an historic first flight of the largest hydrogen-electric aircraft (which continues to hold the record to date).

Concurrently to the final stages of HyFlyer I, ZeroAvia began its R&D towards the HyFlyer II project, designed to deliver a 600kW hydrogen-electric powertrain in a certifiable configuration by 2024. At the close of 2021 ZeroAvia conducted the first ground test, spinning the propeller using the electric propulsion system that will form part of ZeroAvia's hydrogen-electric powertrain for the first time. The initial ground test was part of the overall work to ready the aircraft for a first flight testing the hydrogen-electric powertrain. In the months that followed the first ground test, ZeroAvia has been busy preparing the aircraft for the flight test programme and plans to complete ground testing and achieve first flight by the middle of 2022.

In this first test flight configuration, the aircraft will be powered by a conventional engine on the right side and a hydrogen-electric engine (half coming from hydrogen fuel cell and the other half from battery power) for the left side propulsion. This is part of a sequential approach to safely demonstrate hydrogen-electric powertrain systems powered fully by hydrogen. By the middle of Q2 2023, ZeroAvia intends to conduct a fully hydrogen-electric fuel cell powered flight of a 19-seat aircraft using its ZA600 powertrain as the sole propulsion power source.

This flight test programme will represent a big leap forward in terms of the scale of demonstrations for hydrogen and electric aircraft, and as it develops many world-first milestones will be achieved. The work is in conjunction with project partners the European Marine Energy Centre (EMEC) and Aeristech. The ZeroAvia team is committed to hitting the milestones necessary to deliver entry-into-service of engines to power 9–19 seat flights by 2024.

As well as work to develop the powertrain as part of HyFlyer II, additional core R&D was conducted at Hollister Municipal Airport in California. ZeroAvia's team in California has tested the powertrain technology using its HyperTruck testbed platform. The Hollister team will conduct a similar flight testing and

demonstration programme over the course of 2022 using a second Dornier 228 aircraft.



### The next step

With a mission to put hydrogen-electric, zero-emission engines into all aircraft, ZeroAvia is not focussing purely on the ZA600 powertrain class. The company has already begun some important work in preparation for the next-level ZA2000 powertrain, a 2–5MW engine class to support 40–80 seat aircraft flying up to 1,000 nautical miles by 2026. The company's roadmap involves ultimately extends beyond regional aircraft as well. ZeroAvia has begun preparing facilities in both the UK and US to support the efforts to deliver the furthest reaching and most practical solution for sustainable aviation, and to accommodate the resulting expansion of the company's operations.

### External recognition

Based on this R&D progress, ZeroAvia also garnered significant external recognition over the last couple of years. In April 2022, the company was named a Bloomberg NEF Pioneer. The company was named one of the [world's most innovative companies](#) by Fast Company and a [Technology Pioneer](#) by the World Economic Forum, the company made significant strides on its R&D. ZeroAvia raised over €68m in 2021, taking the total to €112m, with the most recent [round of €34m](#) announced in December. The company also increased its headcount to nearly 100 employees globally.

ZeroAvia is also a representative of the UK Prime Minister's Jet Zero Council.

### Commercial traction

ZeroAvia has announced several highly significant commercial deals to date, amounting to more than 600 commitments for hydrogen-electric engines and several important joint development programmes. In 2021 ZeroAvia cemented a number of deals, including an intention to develop one of the world's first commercial zero-emission routes from London to [Rotterdam the Hague Airport](#), investment and purchase options from airlines such as [Alaska Airlines](#) and [United Airlines](#), and partnerships with a variety of aviation players such as [De Havilland of Canada](#), [Rose Cay](#), [Hindustan Aeronautics Limited](#), [ASL Aviation Holdings](#), and [Mitsubishi Heavy Industries Regional Jet](#) division. The total number of engines (excluding spares) for in-service or stored aircraft produced by the OEMs that ZeroAvia has signed deals with stands at over 7,000; showing the scale of the opportunity.

ZeroAvia has also recently signed deals with [ZEV Station](#) and [Shell](#) to ensure the provision of hydrogen for testing, demonstration and possible early flight routes in California. ZeroAvia has also signed an agreement with [MONTE Aircraft Leasing](#) to offer aircraft leasing and financing solutions that enable operators to run zero-emission flights.

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