



# ABOVE THE CLOUDS

THE FUTURE OF FLYING



GROUPE ADP  
SHARING NEW HORIZONS

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# ABOVE THE CLOUDS

## THE FUTURE OF FLYING

Technology is reshaping the future of air travel. With ambitious commitments to cut emissions across the aviation industry, airports and airplanes are being rethought to make them greener, safer and more efficient. And throughout the whole journey, innovation is helping improve customer experiences, whether that's reducing friction at check-in or providing better in-flight experience.

- 2 FOREWORD**  
The future airport of 2050
- 4 INTRODUCTION**  
Sky's the limit?
- 5 CHAPTER I**  
Destination greener travel
- 11 CHAPTER II**  
Checking in on the passenger experience
- 17 CHAPTER III**  
Making operations plane sailing
- 22 CONCLUSION**  
Is it a bird? Is it a plane? Nope, it's an air taxi

## FOREWORD

# THE FUTURE AIRPORT OF 2050

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The airport industry is being reinvented to meet the new challenges of the future. The result will be an airport in 2050 which is almost unrecognisable to the airports travellers are accustomed to today.

In 2050, as airports will be, more than ever, intermodal hubs, we'll go to an airport to catch a train just as often as we'll go to an airport to catch a flight. In 2050, we'll go to an airport early to make the most of the hospitality, eager to enjoy a seamless journey, innovative services and a unique travel experience.

The passenger path will be totally smooth, as biometric technologies will allow for seamless checking in and home luggage pickup and delivery will alleviate passengers from the worry of heavy and bulky suitcases. Airports will become energy hubs for their own needs and those of surrounding areas. They will also be operated with zero CO2 emissions, and their architecture will be in harmony with the natural environment, encouraging biodiversity and incorporating intelligent urban design. Airports will be connectivity hubs opening up a world of opportunities with ease.

At Groupe ADP we pride ourselves on being pioneers of the airport industry. Consequently, we've started building the sustainable, efficient, accessible and experiential airport of tomorrow, with the help of innovative startups and partners.

That's why, in collaboration with the team at Sifted, Groupe ADP set out to write *Above the clouds: The future of flying*. Reporting on, investigating and analysing innovative and cutting-edge technologies, the Sifted team are sharp experts on the startups, corporates, investors and governments that are building the future. Groupe ADP is a global, integrated and multi-local group present across the entire airport value chain. Combining our expertise together, we asked: what will the future of airports look like, and even more critically, how will we get there?

In the past airports were places of frustration, but by putting hospitality at the heart of everything, Groupe ADP has transformed the airport experience. We aim to guarantee traveller time management and offer excellent hospitality throughout the passenger journey, through digitalisation and an effective operating model.

The report outlines the various ways new technologies have already revolutionised airports and checks in on the startups trialling their innovations in airports right now. Examples include: a luggage checkin and checkout service in the Paris city centre, allowing passengers to leave their luggage at their home or hotel



**Edward Arkwright,**  
deputy CEO of Groupe ADP



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and retrieve it at their destination, powered by startup Alltheway; anti-fatigue mobile armchairs, helping people with reduced mobility, installed by Toulouse furniture specialists Les Flaneuses; and AI tools to supervise mass transit flows, spearheaded by Paris software company Wintics. But there are so many more innovations listed in the pages that follow, including companies that haven't partnered with Groupe ADP just yet (we are always on the lookout for more partners).

The report also highlights the necessary pressure on the airport industry to reinvent itself by decarbonising its activities and electrifying operations. That is why we aim to partner, support and empower startups and innovators to find solutions, including, but not limited to, the widespread integration of hydrogen projects in our airports, the use of sustainable aviation fuels (SAF), creating respect for green spaces around the airport and introducing eco-building and plastic-free operations.

Our ambition at Groupe ADP is to create the airport of the future and inspire others to be part of the process. We host open innovation challenges like *Airport Innovation Days* to enrich startup ecosystems across Europe and the Middle East. We have a technology showroom at the *Innovation Hub* in Groupe ADP headquarters, located in the heart of Paris-Charles de Gaulle airport, showcasing the latest innovations and experiments in progress.

To get to the future airport of 2050, we're focusing on four pillars of innovation:

- **A sustainable airport:** Groupe ADP has set the objective of achieving carbon neutrality at our airports by 2050.
- **An efficient airport:** An airport where technology in the background helps smoothen the process, both airside and landside. The airport is no longer just where you take a flight but a hub where passengers benefiting from easier access from their departure point can choose the optimal mode of transport.
- **An accessible airport:** Infrastructure designed to promote passenger autonomy and facilitate assistance for those who need it.
- **An experiential airport:** Excellence in service, in design and in the commercial offer.

But what do *you* think will get us there? We hope you enjoy your journey through this report, just as much as we did.

## INTRODUCTION

# SKY'S THE LIMIT?

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Sustainable jet fuels. Hydrogen power. AI-powered operations. All frontiers in the future of aviation.

The increasing pressure on aviation to reduce fossil fuel use is kicking all kinds of innovation into gear. New rules in Europe mean airlines will have to progressively switch to greener but more expensive fuel sources. They face a steep climb — and long-haul flights are the biggest thing to tackle, accounting for roughly 80% of aviation's carbon emissions, according to Groupe ADP.

Yet sustainable jet fuel (SAF), which is made up of a diverse range of sources from crops and used cooking oil to household waste, or could be synthesised artificially, can emit about 70% less CO<sub>2</sub> over its life cycle than traditional aviation fuel and is largely compatible with existing planes. It's the airline industry's most realistic shot to reach its target of net zero by 2050. The breakthrough stuff such as hydrogen could also take a bite out of the industry's carbon footprint eventually. It's still in experimental stages and requires transformation of the aircrafts themselves.

Down on the ground, airports are also getting ready for the future. Paris-Charles de Gaulle is mapping flight paths for the cargo and passenger drones that are expected to someday whizz around terminals. In the Netherlands, Eindhoven airport is using AI to improve aircraft turnaround times, while Amsterdam's Schiphol airport is hiring robots to help handle passenger luggage.

What does the future airport look like? Groupe ADP's deputy executive officer development and projects, Amélie Lummaux, has a surprising answer. "It should look like a train station," she says. Like a lot of airport executives, Lummaux is thinking about ways the airport, and everything around it, can leave a smaller carbon footprint. "Around 70% of passengers to Paris-Charles de Gaulle come by taxi or car — we want that to drop severely," she says. It's in this greener spirit that airports are also looking for ways to make the most of the resources they have. "We need to build less and find clever uses for what we already have," says Joyce Abou Moussa, Groupe ADP's deputy director of international development.

But getting a bit greener isn't the only motivation for overhauling the airport: new ideas help to make passengers' lives easier, says Omar Abu Hazeem, airport systems manager at Airport International Group in Amman, Jordan. This airport is using tech to boost the core needs of the passenger, which he summarises as: "clean toilets, fast check out, diverse foods to choose from and fast internet."

In Paris, Abou Moussa is making plans for the day when flying drones will shuttle between terminals, carrying passengers and cargo. "There are a lot of steps to take to prepare our airports for this," she says. "We need to plan the airspace without jeopardising other flights and commercial activities." All this new tech we're seeing will need time to mature — in some cases possibly decades. But squint and you can see an air taxi on the helipad, ready to take you on a short hop from the airport to the city centre.

In this report, we'll take a deep-dive into the future of airports. First, we look at the tech being used to reduce the environmental impact of airports and air travel. Then, we look at the startups and corporates shaking up the customer experience. Finally, we turn to operations and investigate the AI, robots, lasers and drones that are making running an airport plane sailing. Now sit back and enjoy the ride.

# 1 DESTINATION GREENER AIR TRAVEL

Flying has enriched our world, but the environmental toll  
can no longer be ignored



So just how will the aviation industry reduce its carbon footprint?

We know SAF will be the main pathway for large jets to hit their carbon neutrality targets by 2050. For instance, Groupe ADP made a \$20m investment in American producer of SAF products, LanzaJet, in May this year to follow the opening of the world's first commercial ethanol-to-jet plant in Georgia and fund plans to develop factories in Europe, Asia and America.

But this push for more sustainable flight must extend to airports too, where the infrastructure to host future types of aircraft needs to be in place if greener air transport is going to flourish. For example, hydrogen has promise as a jet fuel, but it needs time to mature. Some airports are laying the groundwork already: Air Liquide and Groupe ADP created Hydrogen Airport, the first engineering and consulting joint venture specialising in helping airports integrate hydrogen projects within their infrastructures, for example.

Separately, we're seeing the gradual emergence of flying taxis, which have the potential to be greener than ground-based transport. Germany's Volocopter proposes to shuttle passengers between various Parisian airports and heliports in its electric air taxis. This new kind of vehicle — dubbed the electric vertical take-off and landing, or eVTOL for short — will perform test flights over the next few months. And if Volocopter can meet all the requirements laid down by the European Aviation Safety Authority, the startup is confident it will be cleared for permanent lift-off.

The service Volocopter is proposing is the first of its kind and is definitely ambitious. The first customers will have to be wealthy but later it's hoped the eVTOL will also help out in times of medical emergencies, drastically reducing costs and intervention times, while offering a wider coverage of care. Volocopter is partnering with the German emergency service ADAC on a pilot in late 2024 to supplement rescue helicopters. As well as emergencies, these vehicles could possibly be used for transferring supplies between hospitals.

Ticket prices for commercial uses are to be decided. "Can we achieve a price which is close to a taxi in the future? Yes, we definitely can," says Dirk Hoke, Volocopter's CEO, who previously

headed up Airbus Defence and Space. But on the other hand: "Could we ask for a very high price and the tickets be sold off? Definitely. Demand is already higher than the supply. People will stand in line to get a ticket and be the first ones to fly."

Whatever the price, one thing is clear: Paris is setting the stage for aviation innovation. According to Alban Negret, head of innovation and corporate venture at Groupe ADP, which manages Paris's Charles de Gaulle airport, the company is exploring all futures of carbon-free aviation, including eVTOL. So, 47 years after the first Concorde plane took off from Paris's Orly airport, new types of next-generation aircraft are set to take flight.

At the same time, airport operators are pushing to reduce the environmental impact of all their activities. According to the International Energy Agency (IEA), aviation accounted for 3.1% of total global CO2 emissions in 2019. Demand for travel is only increasing, creating bigger impacts with it. In 2021, Deloitte estimated that aviation will account for as much as 27% of global emissions by 2050 if no changes are made.

Companies like Volocopter are reimagining the experience of flying. But what about operations at the airports themselves?



Volocity flying over Paris (rendering) ©Volocopter



Paris-Charles de Gaulle Airport, France  
©Gwen le Bras for Groupe ADP; artwork: Lila Poppins

## A MORE SUSTAINABLE AIRPORT

Airports are complex, impacting the environment in a number of ways. They take up large amounts of space — sometimes to the detriment of biodiversity — while planes consume fuel at a much higher rate during takeoff and landing. The air quality around airports is also concerning. London’s collection of airports, for example, expose residents to a volume of nitrogen oxide and particulate matter emissions that’s estimated to be equivalent to 3.23m cars per year. Noise pollution is another issue; an impact study for a new airport in Sydney found that up to 12k residents will be affected by noise levels loud enough to interrupt indoor conversations.

Airports are taking various steps towards a greener future, whether it’s securing supplies of SAF, laying the ground for hydrogen infrastructure or generally reducing the impact of all the operations that go on in and out of the airport — from energy management and electrification of ground handling equipment to streamlining waste management.

“Airports are expected to prioritise sustainability, incorporating renewable energy sources, energy-efficient buildings and eco-friendly practices to reduce carbon emissions and minimise environmental impact,” says Baha Bülbül, CEO of BTA Food & Services, a food and beverage company that provides services for 14 airports across the world.

“The airport of the future must be a transportation and energy hub that is integrated into overall regional planning.”

**Franck Meryde**, chairman of the board, TAV Operation Services

“Most airports are looking at how they can increase their [energy] generation,” adds Ian Taylor, the global aviation business leader at engineering consultancy Arup. “They tend to have a lot of land, so there’s often places to put solar arrays.” He cites Changi Airport in Singapore, Cochin International Airport in India and Luton Airport in the UK as examples of airports building their own solar supplies.

Cochin claims to be the world’s first solar-powered airport, with 46,150 panels laid out in a solar farm on the airport’s surrounding land. Groupe ADP, meanwhile, buys power from three solar farms in southern France that will produce 47 GWh of electricity over 21 years — representing 10% of the annual electricity required to operate its three Paris airports.

“The airport of the future must be a transportation and energy hub that is integrated into overall regional planning,” says Franck Meryde, chairman of the board of TAV Operation Services, a subsidiary of Groupe ADP that manages 88 airport lounges in 19 countries.

Construction also needs to be low carbon. Groupe ADP, for instance, is working on a low carbon construction project to revamp level 6 of Paris-Orly airport, which includes new offices built with wood.



**3** SOLAR FARMS IN SOUTHERN FRANCE PRODUCE POWER FOR GROUPE ADP



**47 GWh** OF ELECTRICITY WILL BE PRODUCED BY THOSE SOLAR FARMS OVER 21 YEARS





Velis Electro ©Pipistrel

## NEW MOBILITY

To date, only one electric aircraft (covering all electric-powered flying vehicles such as eVTOLs and electric planes which aren't electric aeroplanes with fixed wings and engines) has been certified by the European Union Aviation Safety Agency (EASA): the two-seater Pipistrel Velis Electro. This means any operator can use it, but only for pilot training.

Despite this, more than \$3bn was invested in the future air mobility industry in 2022, as most aviation experts agree that electrification is coming in one form or another. The question is: where will these flights take off from?

"In Europe, almost all flights operate out of 75 airports," says Gabe Massey, CEO of Pipistrel, the aircraft maker behind the Velis Electro, which is currently the world's only EASA-certified electric aircraft. "There are 3,000 airfields. Our view is that lower emission, lower cost and lower noise aviation, when it becomes available, will need to be at a broader base of operations — not just those 75 hubs."

**"There's a stronger case these days that we can bring aviation closer to the people."**

**Andrew Chadwick**, air mobility and airports ecosystem director, Connected Places Catapult



**\$1bn** IN REVENUES COULD BE GENERATED BY INTRA-REGION AIR TAXI SERVICES BY 2030

**\$90bn** BY 2050

According to Deloitte, by 2040, electric aircraft, which can fly at a maximum range of 500km (which would cover a trip from Paris to London), could absorb up to 25% of European passengers. Longer routes up to 2,000km could be handled by hydrogen-powered aircraft, covering an additional 64% of demand.

Consultancy Roland Berger estimates that intra-region air taxi services, which would displace car journeys between cities, could generate \$1bn in revenues by 2030. By 2050, the figure could be as high as \$90bn. Volocopter's Parisian pilot, of course, will test consumer appetite for such services.

"There's a stronger case these days that we can bring aviation closer to the people," says Andrew Chadwick, air mobility and airports ecosystem director at innovation agency Connected Places Catapult.

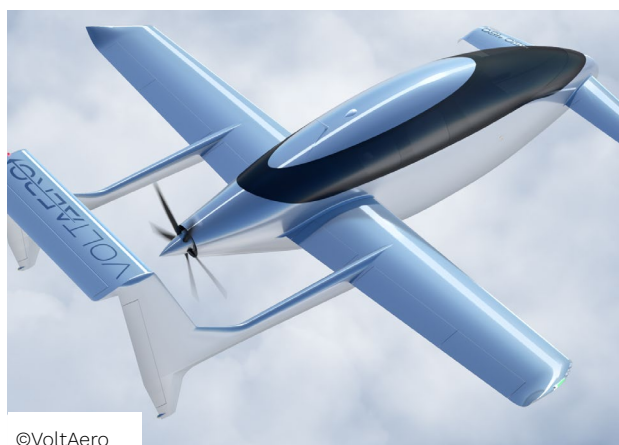
Chadwick says he has already had conversations with property developers in the UK who are enquiring about the practicalities of including vertiports in their projects. Because eVTOLs and electric jets are optimised for travelling smaller distances, it's likely they will be able to make

use of the vast network of smaller airfields that already exist. This could in turn relieve pressure at major airports that are struggling with increasing passenger volumes.

Massey says that the Velis is already teaching the aviation industry important lessons about how these solutions might scale. “It opens up the conversation for everything that’s needed to go up the value chain in electric aviation,” he says. “It will drive airports to start thinking about different approaches to sound and technology, and it will drive regulators to understand how they need to approach different technologies.”

Work is also underway with hybrid planes. In 2026, France’s homegrown electric-hybrid planes may start taking flight. VoltAero, which makes the 12-seater Cassio electric-hybrid aircraft, began construction on a factory to assemble the planes last year. “It’s not only a question of pollution, but also noise emissions that you have to reduce. That’s what we’re trying to do with our Cassio airplane,” says Jean Botti, VoltAero’s CEO. He believes that a distributed transport network that takes advantage of smaller airports will be the future of air travel — and quiet electric-hybrid jets will allow it to happen. “It would not be noisier than a normal car today,” he points out.

Because the Cassio is an electric-hybrid jet, its operators can choose between charging it up or putting jet fuel in it, depending on the infrastructure available at the airport where they have landed. But just as charging networks are a key part of electric cars and vehicles expanding, so too will a charging network designed for planes.



©VoltAero

In the UK, startup Aerovolt is trying to make this happen. It has designed a charger for the Velis Electro aircraft, although the company says it is also working with other electric aircraft makers to ensure its infrastructure is universal.

“We’ve got six chargers installed at the moment on the south coast, and we are engaged with 70 airfields in the UK, including some bigger ones,” says Alan Kingsley-Dobson, Aerovolt’s cofounder. Of those 70, the company has permission to install chargers at 20, including Teesside International Airport.

“When electric aviation does start coming in, having a network in place is the encouragement for the uptake.”

**Alan Kingsley-Dobson**, cofounder, Aerovolt

“It’s a copy and paste of the car industry, going around the aerodromes and saying ‘can we put a charger in your airfield? We’ll put the capex in,’” he says. “When electric aviation does start coming in, having a network in place is the encouragement for the uptake.”

Helping airports to get future-ready is important work, Kingsley-Dobson adds. “Without it, nothing’s going to happen.”



©Aerovolt

## TACKLING AIRPORT PROCESSES

Meanwhile, inside the airport, the number of travellers passing through the concourse — buying food, drink and other things along the way — generates large volumes of waste.

TAV Operation Services has partnered with startups around the world to bring more sustainable solutions into airports. At İzmir Adnan Menderes Airport, one of the busiest passenger traffic hubs in Türkiye, TAV Operation Services has built a sustainable lounge concept where food and plastic waste are tracked. Through its partnership with Istanbul-headquartered Wastespresso, a startup that turns food waste products into biodegradable materials, it diverted around 1,192kg of coffee grounds across a period of six months, diverting 1,077kg of CO2 emissions in the process.

“Minimising waste through better management practices not only reduces costs but also demonstrates a commitment to sustainability, positively impacting public perception,” Mereyde says. “Strategies such as tracking, donation programmes and portion control can reduce waste, [while] better management practices reduce costs.”

TAV Operation Services also provides access to tap water in its lounges in İzmir and New York’s JFK airport, through a partnership with Waternet. Launched in August 2023, TAV Operation Services estimates that it has reduced plastic consumption by more than 1m units.

Airport International Group’s Omar Abu Hazeem says the introduction of smart metres at Queen Alia International Airport has been one relatively easy way to help reduce energy use without introducing big changes.

Other technologies that help reduce the impact of an airport’s operations are being introduced elsewhere. ISB Global, a waste management company based in the UK, has been working with airports to place sensors in bins that can track when the bin is full, and whether or not the right waste has been put into it. The company says its tech can bring cost efficiencies by freeing up cleaners’ time, as they are only visiting bins when they are full, or if there has been a contamination issue (think coffee grounds in the recycling bin).

“Minimising waste through better management practices not only reduces costs but also demonstrates a commitment to sustainability.”

**Franck Mereyde**, chairman of the board, TAV Operation Services

Paris-based Smart Airport Systems, meanwhile, has created a small vehicle that can tow aircraft from the terminal gate to its takeoff point. Aircraft ground movement accounts for an estimated 5–20% of an airport’s carbon footprint — by letting a “taxibot” move the aircraft around, these emissions can be reduced by up to 85%. Maxime Mahieu, Smart Airport Systems’ CEO, says one taxibot could save an airport 3,000 tonnes of CO2 per year.

Bringing these solutions online may require upfront investment, but over time, airports should benefit from reduced costs. Mahieu says the cost of a taxibot is eventually offset by savings on jet fuel.



İzmir Adnan Menderes Airport, Türkiye  
©Mert Curel

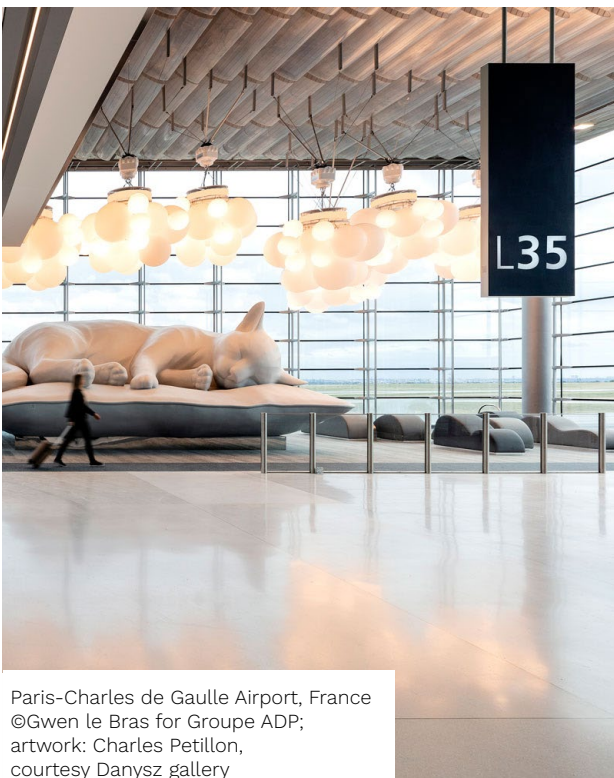
# 2 CHECKING IN ON THE PASSENGER EXPERIENCE

Startups and innovative technologies are reshaping  
how people interact with airports

Let's be honest, going to the airport isn't most people's favourite part of the travel experience. But in the not-so-distant future, cutting-edge technology could make these transport hubs more straightforward for passengers — and perhaps even enjoyable.

Picture this. You arrive at the airport without your luggage, which was whisked away by baggage handlers from your home earlier that day. As you approach the biometric security gates, you glance at the facial recognition cameras instead of rummaging around for your boarding pass. Then you whizz through security, where upgraded scanners have eliminated the usual queues and unpacking of bags. Inside, the retail and hospitality offering feels more Champs-Élysées than concourse, with virtual assistants on hand to direct you to the best cup of coffee. And those sunglasses you ordered on your way to the airport? They're waiting for you at the departure gate. It's only once you settle in your seat on the plane that you realise your passport hasn't left your pocket this entire time.

Welcome to the airport of the future, where artificial intelligence, biometrics and smart infrastructure have redefined the travel experience.



Paris-Charles de Gaulle Airport, France  
©Gwen le Bras for Groupe ADP;  
artwork: Charles Petillon,  
courtesy Danysz gallery

## STRESSED-OUT PASSENGERS SEEK SEAMLESS AIR TRAVEL

Going to the airport has always ranked high for stress among travellers, with a 2020 survey of frequent flyers revealing that 44% find air travel more stressful than going to the dentist. Following the pandemic, stress levels have continued to rise. A 2023 survey by data collection company Yonder found that 36% of people think travelling through airports is more stressful today than it was two years ago.

Technical errors and airports struggling to keep up with surging air travel demand have been the main culprits. According to Time magazine, it took passengers at Düsseldorf Airport four hours to get through security in June 2022. A few weeks later in Amsterdam, the security queue at Schiphol Airport was reportedly so long it snaked out of the airport, across the road and back inside again. At Heathrow, a mound of unclaimed baggage — the result of a glitch with the airport's luggage system — was sitting around for so long that passengers began to complain about the smell.

The chaos continued in 2023 when air traffic control failures led to thousands of flights being halted at UK airports. Heathrow Airport alone cancelled almost 3,000 flights between June and August 2023, while easyJet cancelled 180k flights on July 10 alone. The airline said this was due to air traffic controller strikes in France and the war in Ukraine limiting available air space. Adding to passenger misery, the era of cheap flights also appears to be over, with airfares up 16% as of June 2023 compared to the same month in 2019.

Pressure is mounting on airports to meet demand, with the Airports Council International anticipating average annual passenger growth of 5.8% over the next seven years, with more than 19bn people passing through airports by 2040.



**5.8%** MORE PASSENGERS ARE  
ANTICIPATED IN THE NEXT 7 YEARS

**19bn** PEOPLE ARE EXPECTED TO  
PASS THROUGH AIRPORTS BY 2040

“The challenge airports have is that to be commercially successful, they need to throw as many people through the same space as they can,” says Becrom Basu, a partner at L.E.K. Consulting specialising in transport, travel and new mobility. “However, that has a negative impact on the experience.”

“Reducing passenger stress levels can lead to improved operational efficiency at airports. Stressed and unhappy passengers are more prone to delays, disruptions and negative interactions with airport staff, which can impact overall airport operations,” says TAV Operation Services’ Mereyde. “By providing services that help passengers navigate the airport smoothly and comfortably, we contribute to a more efficient and hassle-free travel experience for everyone involved.”

A number of companies and startups are developing passenger-centric technologies that could be the key to accommodating increased passenger numbers — while improving the overall airport experience.

## MEET THE COMPANIES REDUCING AIRPORT STRESS

The market for smart airport technologies — spanning AI, augmented reality and automation applications — is expected to grow from \$7.1bn in 2022 to a projected \$24.3bn in 2032, according to Allied Market Research.

These technologies could radically reinvent airports, allowing passengers to spend far less time on the administrative aspects of flying, such as documentation and security checks, and more time shopping or eating. Or, they could choose to head straight for their flight: with new services like personalised baggage drop-off, passengers can go straight from kerb to gate without stopping.

In January 2020, Spanish startup Bob.io raised €3m for its service that picks up passengers’ bags from city-centre locations, so it can handle the process of checking them in with the airline. The startup also provides smart baggage tags so passengers can check their bags have been loaded onto the plane.

Another startup is France-based Alltheway, which allows customers to drop their bags off at kiosks

located around Paris before their flight. In June, the startup announced a partnership with hotel group Accor, enabling bags to be checked for flying at the time a customer checks out of the hotel. Alltheway charges €25 for a passenger’s first bag and €10 for each additional bag.

“Air traffic is increasing, and that creates bottlenecks at the airport,” explains Emilie Gazeau, Alltheway’s cofounder and CEO. Alltheway literally gets the baggage out of the way — making it easier for people to travel to the airport and move around inside. “The problem airports and airlines have is that the infrastructure just can’t welcome the increasing traffic, especially at peak time. As a result, it’s causing stress [for passengers].”

So far 1,300 people have used the service, which launched last summer. Gazeau says that 40% of them dropped their bags off on the day of the flight, and 60% the day before. By sorting out the luggage in advance, Gazeau estimates that Alltheway’s solution can increase operational efficiency for airports by 10-20%.

“A side benefit of getting luggage out of the way is to create more time to shop,” she says. “I know when we speak to [airports] they say that removing the stress is quite an important aspect to optimise the hospitality experience.”



©Alltheway

## STREAMLINING THE CUSTOMER JOURNEY

Across Europe, trials are taking place to see if biometric or digital-only IDs could be standardised across the continent, with the European Commission providing funding. In August, a consortium of Finnish companies began trialling the use of digital IDs for passengers flying from Helsinki to Croatia and then the United Kingdom, creating a seamless experience for passengers exiting the Schengen Area.

“Facial biometrics is the way it’s going, expanding that to the full customer journey. One concept is that on the way to the airport, you could check in using your phone, using your face to validate your identity,” says Basu, allowing customers to move through touch points such as baggage drop-off and boarding without showing paper or digital documents.

A 2023 report from ACI World and SITA found that 86% of airports plan to implement self-check-in and self-bag-drop by 2025, while more than half plan to implement secure biometric tokens across “all touchpoints” over the next three years.

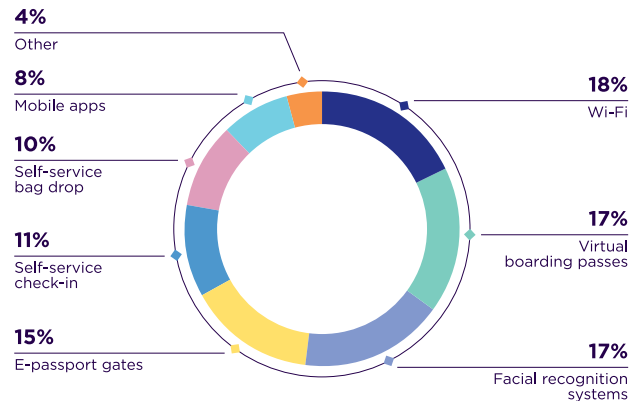
“One concept is that on the way to the airport you could check in using your phone, using your face to validate your identity.”

**Becrom Basu**, partner, LEK Consulting

UK startup Zamna has developed a blockchain solution for airlines that takes care of checking passenger documentation prior to arriving at the airport. The service is good for both passengers and airlines, reducing the number of times someone has to stop and have their passport checked by a member of staff, while also reducing airlines’ exposure to government fines if documentation checks go wrong. Such tech is an easy sell to airlines, who operate on thin profit margins of around \$2.25 per customer, says Zamna founder Irra Khi.

## Wi-fi is what passengers crave most

Results of poll asking 254 people what tech would create a positive airport experience

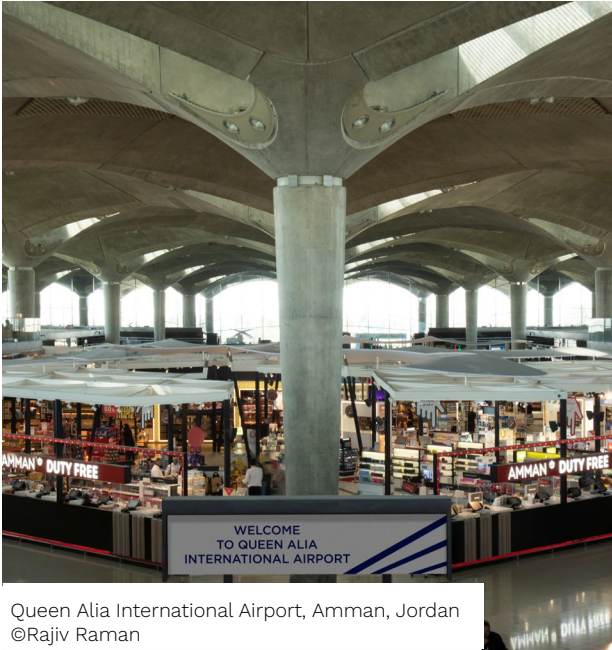


Source: TAV Technologies

“When you think that the UK government fines airlines £2,000 per incorrectly documented passenger, then they’ve just lost every penny they’ve managed to make,” Khi says. Problems such as names being spelt wrong or passport numbers being typed incorrectly into bookings can cause stress and delays at the gate.

Zamna says its airline clients, which include British Airways and WestJet, see 82% of passengers opting in to documentation checks by Zamna. This reflects an ongoing acceptance among passengers when it comes to digitising flight documentation — according to Airport Week, electronic boarding passes now represent 80% of all passes. In March, WestJet reported that a pilot of Zamna’s tech resulted in a 40% decrease in manual document checks, meaning it could get passengers through the gate more quickly.

Navigating the airport itself could also become easier thanks to virtual assistants and augmented reality. Mindsay, a Paris-based startup founded in 2016, develops conversational chatbots that use AI to answer customer questions about flight times and airport facilities. The startup developed its prototype in collaboration with Groupe ADP’s innovation team, and in 2020, it was acquired by Chinese automation startup Laiye.



Queen Alia International Airport, Amman, Jordan  
©Rajiv Raman

In Amman’s main airport, staff are using digital tags to track down trolleys and get them to areas they’re needed quicker. “It’s one small way to enhance the customer experience,” says Omar Abu Hazeem, airport systems manager at Airport International Group.

DeuSens is a Spanish startup providing augmented and virtual reality services to a number of industries, which says its tech can make navigating around airports easier. Instead of travellers having to find signage in the airport, for example, DeuSens’s solution could see them following arrows overlaid on their phone screen to figure out where the toilets are, for instance.

The company can also create “digital twins” of airports, which could enable passengers to explore an airport — and figure out how to move around it — before they have even arrived. The company recently received funding from airport operator Aena to develop a pilot product. Mobee Travel is a platform for travellers with reduced mobility or disabilities. As part of its service, it can reserve accessible transport for passengers, making their journey through the airport a less stressful experience. Last year, the France-based startup raised €1.5m to continue expanding its product.

To monitor elevator usage and passenger flows, Abou Moussa shouts out Paris-based startup WeMaintain, which is experimenting with a laser

box to anticipate breakdown, maintenance management and energy consumption. The company is one of many testing out their tech in Groupe ADP and its partners’ 26 airports. Amélie Lummaux, deputy director general, sustainable development and projects at Groupe ADP, says over 130 experiments have been carried out with startups since 2022 — in mobility and accessibility, decarbonisation and AI.

TAV Operation Services also offers an “All in One” QR code, where passengers can scan a single QR code and get access to a range of services, including menus, reading materials and payment options, through their phones. Mereyde says the service has also cut paper waste by 66% — a happy sustainable side-effect. The company is also experimenting with autonomous service robots in airports in New York and Washington, which help passengers by performing tasks like wayfinding and delivering goods.

## THE “WINDOW OF OPPORTUNITY”

The speed and seamlessness with which airports can get passengers through the boring bits of the flying process and into the lounge can have a significant impact on revenues.

A J.D. Power survey completed this year found that passengers who described their airport experience as “delightful” spent an average of \$44 in the terminal, while those who were “disappointed” spent just \$29.

Underlining the importance of keeping customers happy, Basu estimates that as much as 45% of the average airport’s revenue comes from “non-aero” spending, which includes anything travellers purchase via the airport, such as car parking, catering and retail.



**\$44** AVERAGE SPENT IN THE TERMINAL BY PASSENGERS WHO DESCRIBED THEIR AIRPORT EXPERIENCE AS “DELIGHTFUL”

**\$29** AVERAGE SPENT BY PASSENGERS WHO WERE “DISAPPOINTED”



“If you are at an airport, the window of opportunity you have is small — it’s basically the time you spend between security and boarding,” says Daniel Haller, delivery lead at ecommerce platform Omnevo. Omnevo creates retail marketplaces for airports, airlines and railways, allowing them to sell both products from the retailers that have stores within the airport, as well as services like parking. The company has worked with Frankfurt, Heathrow and Zurich airports. It can be a complicated experience to bring online.

“As an airport, you have a big assortment of products,” says Heller, pointing out that they operate like shopping malls. “But you are not the merchant of record. You facilitate the deals, but you don’t take the money.”

## “Self-checkout options empower customers to take control of their shopping journey.”

**Daniel Haller**, delivery lead, Omnevo

Ersan Arcan is CEO of ATU Duty Free, a company that provides duty free services in over 110 stores in seven countries. He says streamlining the checkout experience is key.

“By embracing self-checkout systems, we not only improve customer satisfaction but also enhance operational efficiency,” he says. “Moreover, self-checkout options empower customers to take control of their shopping journey, creating a sense of autonomy and empowerment.”

Creating a streamlined ecommerce experience also allows airports to collect customer data, creating personalised experiences such as delivering items to the gate for individual customer collection. It could also encourage phone-obsessed Gen Zers to buy more — 28% of this generation has purchased products through apps, for example.

Duffle is a Berlin-based travel shopping startup that combines the airport marketplace with the

speedy grocery concept, with a crew of Duffle runners waiting at the airport to pick up orders and hand-deliver them to a shopper’s gate. It allows shoppers to order items up to 20 minutes before boarding time and it recently scored an undisclosed investment from Dufry, the world’s biggest airport retailer.

Arcan agrees that omnichannel options are increasingly important to airports. “Our omnichannel approach allows us to engage with customers at every stage of their shopping journey, from initial browsing to final purchase and beyond,” he says. “By leveraging technology and data-driven insights, we’re able to offer personalised recommendations, real-time inventory updates and a consistent shopping experience across all touchpoints, both online and offline.”

## BUILDING BETTER AIRPORTS

As the air travel landscape continues to evolve and adjust to a post-Covid normal, the airport of the future will be a place that promises a more seamless and enjoyable experience for travellers. The traditional stressors of long queues, security hassles and fears of lost luggage could even become worries of the past, thanks to a wave of innovative technologies reshaping the passenger journey.

This transformation is not just about convenience for the passenger: startups that provide services to help passengers get to their flights more quickly will also be critical contributors for airports seeking to boost revenues.

Some of the most forward-thinking airport operators in the world are showing that these buildings don’t need to be a place where people simply pass through — they can be destinations in and of themselves. This year, Hamad International Airport in Doha won the title of world’s best airport, thanks to its unique take on passenger experience. It contains an “orchard” for flyers to rejuvenate between flights.

As startups and new cutting-edge technologies continue to reimagine the modern travel experience, ambitious airports will have the opportunity to set new standards for passengers.

# 3 MAKING OPERATIONS PLANE SAILING

Airports around the world are adding AI to everything —  
and hiring robots to take care of your bags



It's *really* hard to introduce big changes to an industry that never fully shuts — and yet airports have little choice but to lean heavily on new technologies because airports can only scale so much, build so much and hire so many people.

“The airport only has a fixed amount of tarmac — you can't go and build another terminal or runway down the road,” says George Richardson, CEO and cofounder of UK-based airport software supplier AeroCloud Systems. “So if you're not using the best tech to optimise your tarmac, you'll have drastic revenue leakage.”

From processing passengers quicker to keeping people safe and speeding up aircraft turnaround times, the changes we're seeing have the potential to turn airports from places of frustration into pillars of innovation.

## WINGING IT

Before discovering his true calling to help airports run like clockwork, Richardson spent 10 years as a professional racing car driver. The life became a grind. “My contract was up for renewal at the end of every year, so it's like doing the whole pre-fundraising thing all the time. It's way more stressful than actually running a business,” he says.

After quitting racing, Richardson stumbled into the aviation industry almost by accident. “I first met my [future] cofounder in a Costa Coffee in Cheshire,” he says. “We got the idea to work with airlines to sell unsold seats — and quickly discovered airlines are really hard to sell to.”

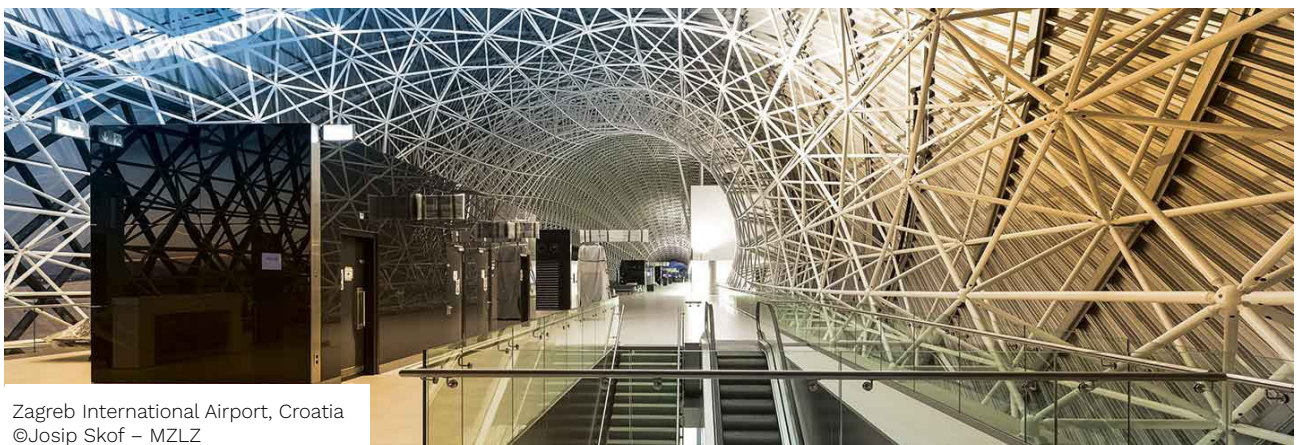
So that idea was a bust. Then Richardson got a new plan. “We thought about the shift of airlines flying to small, regional airports, which serve 20m-or-below passengers a year. The technology in these airports wasn't very impressive. It wasn't built for them, it was built for large airports. These airports were ill-loved by legacy systems.” Many airports have computers and ground control systems that can be up to 30 to 40 years old. AeroCloud, the company Richardson started in 2019, ran a survey of 200 global airport leaders recently and found that 40% are still using Excel and Word documents to store and manage operational information.

“There's so many people with a stake in the way the airport is run.”

**George Richardson**, CEO and cofounder, AeroCloud Systems

“There's so many people with a stake in the way the airport is run, whether it's retailers like WHSmith or coffee shops, airlines, passengers, security, hotels, bus and taxi companies,” he says. “There's a shedload going on: we give you a crystal ball so you feel you have a grip on things.” The AeroCloud tool lets airports collect and store all kinds of data, from flight information to updates on ongoing projects.

For Richardson, proof of his company's progress is the fact that, “I can get a meeting with Heathrow now,” he says. “They didn't have time for me three years ago.”



Zagreb International Airport, Croatia  
©Josip Skof – MZLZ

## AI IN PLANE SIGHT

When airport and airline managers talk about upgrades they want to make, they mention AI a lot.

Take flight management. According to the International Air Transport Association, airlines spend over \$200bn annually, a fair chunk of which can be attributed to route planning, influenced by factors like air traffic congestion, rapidly changing weather patterns and fluctuating fuel costs.

New tech platforms from companies like US-based Air Space Intelligence use flight data to identify less congested flight routes and bypass areas with dire weather. Alaska Airlines has already tested this tech and says it has resulted in savings of 480k gallons of fuel and a reduction of 4,600 tonnes in carbon emissions over six months.

“AI, particularly generative AI, is not over-hyped. Its ability to analyse and understand vast amounts of data makes it a game changer in airport operations,” says Kerem Öztürk, CEO of TAV Technologies, part of TAV Airports, which develops tech for airports around the world, and CIO of TAV Holding, also part of TAV airports.

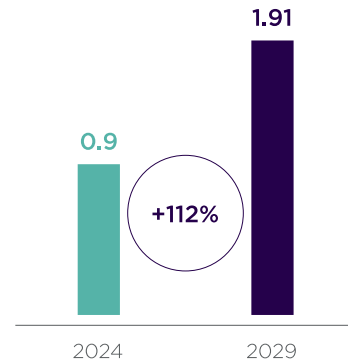
Airlines are also investigating the potential of AI to flag future problems: British Airways, for example, is using AI to predict when a plane is likely to develop a fault, so preemptive fixes can be made, instead of waiting for failures to be spotted close to take off. Down on the ground, airports are using AI to automate how they manage inbound and outbound flights. If airports can stay on top of this data and speed up aircraft turnaround times, they can potentially take on new airlines.

“AI, particularly generative AI, is not over-hyped. Its ability to analyse and understand vast amounts of data makes it a game changer in airport operations.”

**Kerem Öztürk**, CEO, TAV Technologies; CIO, TAV Holding

## Airports don't deploy many bots yet — but this will slowly change

Market size in US\$bn



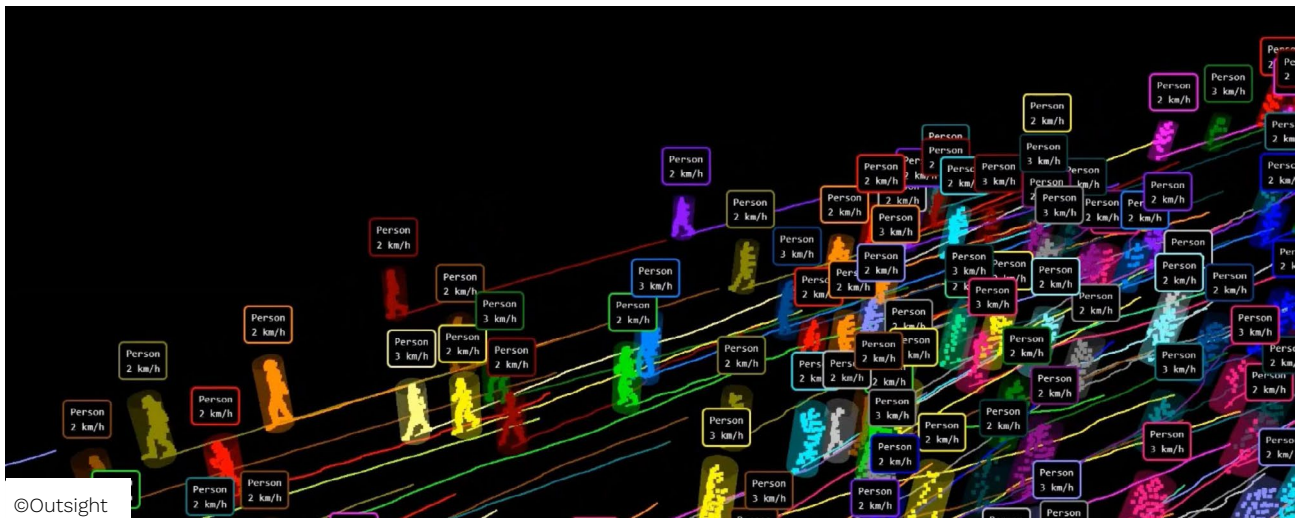
Source: Mordor Intelligence

This work could be improved if airports and airlines shared more data, says Omar Abu Hazeem, airport systems manager at Airport International Group. “There’s reasons they don’t do this consistently today – mainly for reasons of security. But I think we’ll see more sharing in the future,” he says.

Big airports are testing or developing various autonomous projects. ASTAIR, an EU research project that started in 2023 and includes Groupe ADP, is working on an AI tool to prompt certain ground actions at the airport, such as providing clearances to vehicles according to optimal routes.

Schiphol Airport, which is based in the Netherlands, has said it aims to achieve a fully autonomous airside operation by 2050. UK-based Oxa is one of a number of companies developing software to power autonomous vehicles. This kind of tech is perfect for airports, says Richard Jinks, the company’s chief commercial officer. “Trips around an airport, whether it’s ones carrying passengers or cargo, run from point A to point B, over and over again. That’s what robots are best at: repeatable journeys.”

But as helpful as AI and autonomous systems will undoubtedly prove to be, few expect this tech to be able to handle the most complex tasks — the future airport will come with *actual* humans.



“I cannot imagine that areas like crisis management and strategic planning will be replaced by AI tools,” says Mete Erna, general manager of Türkiye-based Havaş Ground Handling Company, which provides ground handling services to more than 200 airlines at airports in Türkiye and abroad. “The ability of people to come up with creative solutions when faced with sudden changes, emergencies or unforeseen events is critical,” he adds.

Autonomous vehicles were not economical until recently, Erna adds. Workers quitting the airport for other industries following the pandemic has caused a rethink. “With many hesitant to return to aviation, the financial feasibility of such solutions can improve, especially in developed countries where employee shortage continues and labour costs have increased in recent years,” he says.

### LIDAR’S RAPID ASCENT

An airport’s bread and butter is to process a huge volume of passengers every day. For evidence of this challenge, look no further than the UK’s busiest airport, Heathrow, which processed over 7m passengers in September 2023 alone. Airport managers want consistent passenger flows, so they need to predict as many arising issues as possible.

LiDAR (light detection and ranging) — which works in a similar way to radar and sonar, but using lasers rather than radio or soundwaves — is being promoted as a key tool to identify airport bottlenecks faster.

Raul Bravo is president and cofounder of France’s Outsight, which has developed LiDAR systems for the Paris-Charles de Gaulle Airport. He lists three advantages of the tech: it functions in all lighting conditions, including total darkness and direct sunlight; it detects depth, including the position and size of objects; and it inherently ensures privacy, as no personal information is ever captured from these systems.

“LiDAR helps us understand how people are using the airport,” says Bravo. For example, the expectation at airports now is that most passengers will arrive with wheeled suitcases, so fewer trolleys are needed than before. But how many should you keep on hand anyway?

“LiDAR helps us understand how people are using the airport.”

**Raul Bravo**, founder, Outsight

“The airport needs to understand this,” Bravo says. “If there are a lot of trolleys being used in a particular part of your airport, that’s not great for ensuring a smooth flow of people.” LiDAR learnings allow airports to react quickly to issues, he adds, whether this means opening more check-in desks or more security lanes when queues peak. It could also prompt janitors to clean particular bathrooms more regularly depending on the number of passengers using them.

## CAN ROBOTS BE A 'RUNWAY' SUCCESS?

Another way to keep people moving smoothly through the airport is to reduce time going through security. New tech can help.

From summer 2023 on, all passengers departing from Helsinki Airport are able to take up to two litres of liquids in their hand luggage, according to the national airport operator Finavia. This is because the airport installed modern luggage scanners that no longer require passengers to separate and remove items like liquids and electronic devices from their bags.

An increasing number of airport jobs are being outsourced to tech. If you're travelling through Belfast Airport, for example, your meal will be delivered to you by a cheery robot waiter. Robots at Heathrow are helping to clean the lounges. If you're in Dubai, you can go to Emirates's remote check-in facility in the city's financial district and meet Sara, a portable robot assistant designed to help customers check in for flights and drop off their luggage.

Texas's San Antonio Airport will shortly introduce a security robot, which is capable of carrying out people detection and thermal anomaly detection, as well as license plate recognition. The robot's main duty, however, will be to stand near restricted doors and respond to alarms. The bot will take a photo of any person who triggers an alarm and relay the information to the command centre so human staff can check if the individual is allowed access.

According to French company Vanderlande, robots should also be taking a greater load off overstretched baggage handlers. "While current regulations indicate that one person should handle a maximum of 216 bags per day, it appears that during busy days a handler may need to lift up to this amount of bags per hour," a Vanderlande research paper reads.

Schiphol Airport announced in 2023 that it would buy 19 baggage robots from Danish company Cobot Lift. The airport expects that these robots can eventually take on 80-90% of the baggage lifting.

Robots may even tow planes in the future. In 2019, a robot dog built by the Dynamic Legged

Systems lab at the Italian Institute of Technology pulled a three-tonne light airplane at Genova City Airport.

For jobs where humans are completing arduous physical tasks, exoskeletons — mechanical structures that can be compared to the bones of a human body — are being tested by state-owned French railway company SNCF. Built by French company Ergosanté Technologie, the exoskeleton is an articulated brace designed to reduce the risk of physical ailments when conducting maintenance on trains.

## KEEPING DRONES ON THE NO-FLY LIST

Airports have a healthy paranoia over security — and one incident that lives on in security managers' heads is the fiasco at Gatwick in 2018, when a drone sighting caused the airport to close for two days.

"It was a nightmare," says Loic Brivezac, CEO of Hologarde, a subsidiary of Groupe ADP. "It cost tens of millions and they never understood who was behind the attack." The incident was the first time a major airport was shut down by drones; more than 1,000 flights were cancelled and more than 140k passengers affected.

The main idea behind Hologarde is to prevent another Gatwick scenario. The company develops cameras trained to detect drones in the sky and relay the coordinates to command control. "We can see something in the region of seven to eight kilometres outside the airport perimeter," Brivezac says.

Not every airport is thinking about drones, he adds. "It can be hard to explain how things weighing as little as 800 grams are threats. It's harder still to explain how they might be opportunities," he says.

Hologarde both protects the airport from drone attacks while also preparing for the day when friendly "collaborative" drones may be buzzing around the airport delivering stuff. Traffic around an airport will increase in the future, Brivezac explains. "It could be drones or it could be flying taxis: we have to manage all the flight lines and ensure that every flight goes as planned."

## CONCLUSION

# IS IT A BIRD? IS IT A PLANE? NOPE, IT'S AN AIR TAXI

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So there we have it, a journey through the tech that is changing airports — and air travel — across the globe. One thing is for sure, it's about to get a lot greener, a lot more efficient and a lot more comfortable for passengers.

Within the next decade, eVTOLs are expected to start taking off. Sceptics may ask whether air taxis will ever find enough compelling or profitable reasons to exist. Proponents say these vehicles will not exist merely as taxis or tourist attractions but will have a meaningful purpose, such as helping with air rescues or transporting supplies during medical emergencies. What is more certain is the adoption of climate-friendly innovations. Pressure from regulation and the climate crisis itself means that airports are already making changes, with more to come. A happy effect of these changes? Costs for airline operators go down too.

After (or before) the climate impact of airports, the next thing on operators' checklists is the passenger experience. We checked in on the startups and technologies shaping how customers interact with airports and found lots of progress. The future airport where you glide through the concourse with your every need taken care of might be a way off, but you *can* now have your luggage picked up from your hotel in Paris, instead of having to lug it all the way to the terminal, and blockchain technologies are allowing documentation to be checked before arrival, getting people through the gate much more quickly.

Finally, we saw startups shaking up the way airports are run, from data collection tools optimising regional airports to AI predicting when a plane might develop a fault to autonomous vehicles taking luggage from A to B. Of course, the experts noted technology will not replace people in every area, it will just help them. Even an airport in 2050 won't be fully run by robots.



Volocity flying over Paris (rendering) ©Volocopter

# A SPECIAL MESSAGE

From the Olympics and Paralympics to the future of flying

The future of airports is bright. The aviation sector is on the verge of a groundbreaking transformation to address the many hurdles it faces - providing travellers with seamless journeys, while adapting to environmental and societal challenges.

One colossal challenge Groupe ADP is taking on this year is the 2024 Paris Olympic and Paralympic Games. To manage the 17k+ oversized bags expected and welcome thousands of Olympic and Paralympic athletes, this global event will require the strong expertise and operational excellence of the whole airport community. But our airports will be the gateway to the Games. We are ready to use this opportunity to showcase some of the best innovations in the sector, cementing our airports' places at the forefront of the future of travel.

In 2012, Groupe ADP set out on a journey to design the airport of tomorrow - with the assumption that global travel needed to decarbonate to stay viable. Our 2025 Pioneers strategic plan has continued on this trajectory by putting innovation at the heart of our ambition to tackle carbon emissions. We've created a more sustainable model, decarbonising operations first on the ground, then in the air, with the objective that in a few years' time, the aeronautical sector will no longer be responsible for increasing CO2 emissions. From electrifying air-conditioning operations and the taxiing of aircrafts on the ground to enhancing the use of renewable energies to heat our terminals and power other activities, it's been no small feat.

More than ever, our role is to bring together the many players within our ecosystem and offer our longstanding operational expertise to the wider sector to provide it with solutions, develop innovations and push the boundaries of the travel experience. Since day one, our obsession has been to uphold and advance customer satisfaction in all our airports. Because of this, Groupe ADP and its network is now a global leader in terms of passenger experience. Paris Charles-de-Gaulle airport was just voted the best airport in Europe and 6th best in the world by Skytrax - and five other airports in the Groupe ADP network also made it into the top 100.

As a visionary actor, Groupe ADP will continue to set the path for the future of travel. The expertise and passion of 6k women and men are at the heart of our success, along with our trusted partners and the aviation sector at large. It is with great confidence that I believe Groupe ADP will remain at the forefront of transformations in the coming years - upholding operational excellence and building a global digital ecosystem, by relying on our multicultural DNA and strong regional foothold. The future for us — and for airports — is bright.



**Augustin de Romanet,**  
Chairman and CEO of Groupe ADP



# ACKNOWLEDGEMENTS

We would like to thank the following people for contributing their insights to this report.

## Joyce Abou Moussa

Deputy director of international development, Groupe ADP

## Mete Erna

General manager, Havaş Ground Handling Company

## Maxime Mahieu

CEO, Smart Airport Systems

## Omar Abu Hazeem

Airport systems manager, Airport International Group

## Emilie Gazeau

Cofounder and CEO, Alltheway

## Gabe Massey

CEO, Pipistrel

## Ersan Arcan

CEO, ATU Duty Free

## Daniel Haller

Delivery lead, Omnevo

## Franck Mereyde

Chairman of the board, TAV Operation Services

## Becrom Basu

Partner, L.E.K. Consulting

## Dirk Hoke

CEO, Volocopter

## Alban Negret

Head of innovation and corporate venture, Groupe ADP

## Jean Botti

CEO, VoltAero

## Richard Jinks

Chief commercial officer, Oxa

## Kerem Öztürk

CEO, TAV Technologies; CIO, TAV Holding

## Raul Bravo

President and cofounder, Outsight

## Irra Khi

Founder, Zamna

## George Richardson

CEO and cofounder, AeroCloud Systems

## Loic Brivezac

CEO, Hologarde

## Alan Kingsley-Dobson

Cofounder, Aerovolt

## Turgay Şahan

General manager, TAV Security

## Baha Bülbül

CEO, BTA Food & Services

## Amélie Lummaux

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## Ian Taylor

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Cover image generated using Midjourney.



This report is sponsored by Groupe ADP.

Groupe ADP develops and operates airports, including Paris-Charles de Gaulle Airport, Paris-Orly Airport, and Paris-Le Bourget Airport. In 2023, under the Paris Aéroport brand, the Group welcomed 99.7 million travellers at Paris-Charles de Gaulle and Paris-Orly Airports, and 336.4 million passengers at the airports it manages overseas. With the advantage of an exceptional geographic positioning and catchment area, the Group is pursuing a strategy of expanding traveller capacity and improving service quality, while also developing its businesses and real estate activities. In 2023, the Group's revenue was €5.495 billion, delivering net income attributable to the Group of €631 million.

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**Groupe ADP**

TAV Airports provides integrated services in all areas of airport operations, with a global footprint at 110 airports in 33 countries. A member of Groupe ADP, TAV Airports is part of the leading airport management platform globally. Through its subsidiaries, TAV is active in airport service businesses, including duty-free, food and beverage, ground handling, IT, private security and commercial area management. The company is quoted on Istanbul Stock Exchange.



Queen Alia International Airport (QAIA) in Amman is the Hashemite Kingdom of Jordan's prime gateway to the world, operated by Airport International Group, with a 51% majority stake held by Groupe ADP.

Comprising a 170,762 sqm terminal and two parallel runways 3,660 meters long, QAIA boasts the capacity to handle up to 12 million passengers per year, serving destinations across the Middle East, Europe, Africa, Asia and North America.

As a testament to its steadfast commitment to passenger satisfaction, QAIA was granted the title of 'Best Airport by Size and Region: Middle East' for airports serving five to 15 million passengers five times since 2017 based on the Airports Council International World (ACI World) Airport Service Quality (ASQ) Survey.

On the environmental front, QAIA also became the first carbon-neutral airport in the region, as well as the first in the Middle East and second in Asia-Pacific to achieve Level 4+ 'Transition' of the Airport Carbon Accreditation Program.



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