



JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Artificial Intelligence as a backbone to the success of Next-Gen Global Aviation Industry

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Abstract :

Artificial intelligence or AI is now being utilized in a variety of industries across the globe. It particularly is making its mark in the aviation industry as airline companies continue to experiment with how AI can make flying faster, safer, and more convenient. While these experiments are in the earliest phases right now, they are showing promise that could allow AI to have a solid future in tomorrow's aviation industry.

Key Words:

Artificial Intelligence, Airline, Price Optimization, Revenue, Passenger and Cargo Operations, supply chain management, flight capacity, Air safety and airplane maintenance, Crew Management, Fuel Efficiency Optimization, In-flight sales, Fraud detection and management, Flight management and autonomous taxi, take-off, and landing in the future, customer experience, predictive aircraft maintenance, route planning, customer experience, data analysis.

Keeping Up with Growing Industry Demands

By all accounts, the global aviation industry is growing at an unprecedented pace. Within the next few years, passenger counts are expected to double. This increased demand could put a strain on the systems that are in use today at airports across the globe.

With AI, however, the demand could be easily met without putting additional strain on an airliner's operations or budget. It also could satisfactorily maintain and control important facets of this industry including keeping track of safety records, keeping down costs, increasing customer satisfaction, and generating more revenue.

Passenger Identification

Artificial intelligence is already being used in select airports to identify passengers and handle ticketing matters. In fact, it has proven itself capable of performing end-to-end passenger identification and check-in functions at the airport.

Some airports are already using AI in ticketing kiosks that allow passengers to check in quickly without having to wait in long lines. It also is being used by some airlines in mobile apps that allow passengers to check in for flights from the touch of a smartphone or tablet computer.

Further, AI is expected to be in use soon for the purpose of self-service flight check-in. Customers will use this technology in kiosks that will feature facial recognition. It is expected to facilitate faster check-ins and speed up customer flow at the airport while also improving customer satisfaction.

Baggage Screening

AI will also prove critical in the process of screening customers' baggage. With AI, customers can have the size of their baggage determined before they even arrive to the airport and check in for a flight. They can additionally use a mobile app to prepay for any baggage-related expenses.

Customer Assistance

One of the most frustrating aspects of flying for many customers is getting assistance with commonly asked questions or concerns. Customers either have to wait in line at the airport or call and then await on hold for long minutes before they can reach a live agent for help.

These old ways of getting help with questions and concerns could soon go by the wayside in favor of AI. With AI, customers could soon use technology like Amazon Alexa that can be paired with an airliner's mobile app. Alexa can then be used to:

- answer questions
- address common concerns
- check the status of a flight by number
- handle check-in requests
- ask about the availability of amenities like WiFi during a flight

Customers will no longer need to call a customer service number or wait in line at the check-in counter at the airport to speak with a live person. They will get information at their fingertips using AI.

Predictive Maintenance

Finally, AI could soon be used to maintain and repair airplanes. Experiments are already underway to determine how well AI can optimize maintenance planning and capacity of airliners.

It is showing promise in being able to reduce the need for routine maintenance by triggering repairs only as they are needed. Further, AI can increase an airliner's fleet availability by up to 35 percent, all the while reducing labor costs by as much as 10 percent.

It can also predict potential issues with airliners by using data from in-service aircraft. AI will be able to use algorithms to predict flight delays and faults with airplanes. As a result, it could allow both airliners and airports a better chance of avoiding serious issues that could disrupt traffic, revenue, and customer satisfaction.

Artificial intelligence could soon transform the way that airliners operate and serve customers. It could facilitate faster check-ins and allow customers to handle many of their own flight-related issues like checking in and paying for baggage-related costs. AI also can keep more airliners in the sky and reduce a company's repair and labor costs.

How AI Is Impacting the Aviation Industry

The hardware that gets us off the ground has changed a lot since the Wright Brothers and their first flight, but there has always been a human element in the aviation industry. From the pilots and flight attendants in the air to the engineers and mechanics on the ground and the air traffic controllers in the tower, everything except the air currents themselves are in human hands.

This has been more than sufficient. But as air traffic continues to increase — especially in the wake of the pandemic — we need some new tools to pick up the slack. How is artificial intelligence (AI) impacting the aviation industry?

AI in Ground Handling

Ground handling is often one of the biggest challenges when it comes to keeping an airport on schedule. One team missing their ground handling window can create a cascade effect that leaves everyone sitting on the tarmac for extended periods, plus feed into delays at other airports as well.

In this situation, AI can help predict ground handling times, plan ideal schedules, and prevent teams from stepping on each other's toes as they try to go about their day.

It can also be an incredible tool for improving communication to make the entire ground handling process move smoothly and more efficiently. The more information these AI systems have to work with, the more accurate their predictions become.

Assisting With Airport Security

While safety and security have always been important in the aviation industry, in the last two decades since the tragic events of September 11th, 2001, airport security has been honed to an exacting science. As with most things, though, there is always room for improvement. AI has become a valuable tool in aviation security training, especially as computing power has exponentially increased.

An AI system can observe and analyze any and all systems that might be vulnerable to attack and determine whether there are any risk factors that a human security analyst may have overlooked. These AI systems can process many times the information that a human analyst could manage in their lifetime, creating accurate real-time projections of security risks on and off the ground.

With a bit of programming and historical data, they can even create projections for topics like the efficiency of fire extinguishers in a closed cabin environment without ever having to take an aircraft offline for testing.

The Rise of Virtual Assistants

Virtual assistants are popping up in nearly every industry, with a variety of different applications depending on the needs of the user.

For the aviation industry, AI assistants are beginning to emerge as tools for both aircraft crew and passengers traveling to their destinations. Garmin has begun creating AI-powered aircraft audio panels that can provide the pilot with information about wind forecasts, weather, and more while also handling repetitive tasks like changing radio channels.

On the passenger side of things, AI assistants and chatbots are quickly becoming one of the most valuable tools in the industry. Instead of using their customer service teams to field repetitive or common questions, virtual assistants can help people find flight numbers and times, book and plan trips, and handle all sorts of different mundane tasks, freeing up the customer service team to handle more complex problems. AI-powered

chatbots can reduce operational costs by up to 30%, and experts predict that by the end of 2021, upwards of 85% of customer interactions will be handled by chatbots without any human interaction.

Aircraft Health Monitoring

The internet of things (IoT) is working to connect everything from phones to home appliances. But these networked sensors can also be valuable tools for monitoring the health of an aircraft.

These aircraft are already packed with sensors that monitor everything from temperature and fluid pressure to the amount of noise each component makes. Adding AI to the mix and networking the sensors just takes these information-gathering tools to the next level.

Instead of responding blindly to alerts when an aircraft touches down, airline mechanics will have a health readout for the plane on hand before it ever touches the ground. This, in turn, can improve ground handling times and prevent delays that can cascade throughout the airport system.

The Future of AI in the Aviation Industry

Applying artificial intelligence to the aviation industry is something that is just beginning to take off. This technology is in its infancy, relatively speaking. But as its adoption becomes more widespread, we will likely see more potential applications emerge. We're a long way off from Hal Jordan or Tony Stark's suggestion of "removing the pilot entirely," and there will always be situations where the skills and instincts of a human pilot will be superior to the programming of an AI system. But the potential is there.

Artificial intelligence will continue to change and shape the aviation industry for many decades to come. What we're seeing right now is the beginning, and we're excited to see where it might end.

How AI Will Change Aviation In The Future

As commercial aviation strives to minimize human contact in a bid to make passengers and staff feel safe in the post-pandemic era, what better time to take a look at what is going on with Artificial Intelligence in the realm of air travel? Previously accused of being slow in its application, AI in the aviation market is now expected to grow from \$152.4 million in 2018 to \$2.2 billion by 2025.

"FLY AI"

In March this year, the European Aviation High Level Group on AI published its first "FLY AI" report. The document pools the expertise of EUROCONTROL with that of several key actors such as air navigation service providers, airlines, airports, plane manufacturers, EU bodies, military, and more.

"With European aviation facing growing pressure to reduce its environmental impact, as well as persistent capacity bottlenecks, we need more sophisticated changes on the ground and in the air (...). Artificial Intelligence can be a key ally in pursuit of this goal," Adina Valean, European Commissioner for Transport, commented on the report.

"FLY AI" found that Artificial Intelligence has a huge potential for use in areas that feature complex scenarios, such as the optimization of support for Air Traffic Controllers (ATCOs), Air Traffic Safety Electronics Personnel (ATSEPs), pilots, airport operators, flow controllers or cybersecurity officers.

For example, in 2019, air traffic management service NATS began a trial at Heathrow Airport to see if the use of ultra HD 4K cameras combined with machine learning technology, could be used to help improve the airport's landing capacity in times of low visibility and improve punctuality.

In 2018, Rodin Lyasoff, CEO at A³ by Airbus, the manufacturer's Silicon Valley innovation center, according to Forbes, said that areas such as taxiing and ground operations are "ripe for disruption" through AI capabilities.

Software for security

Also last year, AI security company Synapse Technology announced the release of the first patented AI platform for X-ray machines, called Syntech ONE 200. A software designed to improve the effectiveness of check-point scanners, it has already been ordered by Osaka's Kasai International Airport.

Wide range of application

Even though aviation has sometimes been accused of lagging behind other areas in its use, AI has already brought some significant changes to how flights are operated. Thus far, it is widely implemented by airlines and airports for facial recognition, customer Q&A, baggage check-in, factory space, and fuel optimization.

However, its application areas are much broader. Mostly, it comes down to the same objectives, namely cost-efficiency and the improvement of customer experience.

Aircraft management is an arduous task that, if done inefficiently, can cost a carrier enormous amounts of cash. AI systems can predict when maintenance is required, helping airlines optimize service. Like when Delta Air Lines slashed its maintenance delays by 98% in 2018 by focusing on Big Data and predictive maintenance, as reported by Forbes.

Ticket prices and crew management

AI algorithms could also help airlines optimize ticketing prices, which are built on multiple parameters such as seasonality, fuel prices, competition, etc. Faculty, a British company specialized in AI solutions, has developed an AI model that was able to provide forecasts that were between 70% and 80% accurate up to 90 days before every flight

Then there is crew management. Factors such as certification, availability, and qualification of pilots, flight attendants, and engineers must all be taken into account. To schedule and re-schedule staff using an AI-based roster system would increase HR efficiency and hopefully optimize layovers for crew.

Will R&D suffer?

Before the pandemic struck, 52% of airlines were planning major AI R&D programs within the next three years, and 45% of airports in the next five, according to Aviation Business News.

Business and technology grow together. As commercial airlines struggle to make a comeback after the worst crisis ever to hit the industry, they would do well to look towards the future and not pull back from investing in innovation.

Machine Learning in the Airline Industry : The Next Step

- Opportunities for Airlines to improve on profits using Artificial Intelligence

The significant changes in the airline industry can be aptly described by the quote ‘Necessity is the mother of Innovation’. In the past 2 decades, airline operations have provided innumerable innovative ideas to the world that can be applied to a majority of consumer-facing industries. Some of these ideas include dynamic pricing, revenue management systems, operations scheduling to optimize cost. A concept like dynamic pricing was unthinkable 10 to 15 years back. It introduced the idea of different customers paying a different price for the same product at the same time all being profitable.

The necessity behind such innovations is that the airlines are one of the most distressing industries in the entire travel & tourism chain. The players in the industry operate on a very narrow profit margin. Hence, it becomes significant for them to develop strategies that earn the maximum profit and at the same time helps them to win the competitive price war.

According to one of the reports by Mckinsey, travel companies and airlines, in particular, have 23x greater likelihood of customer acquisition, 6x customer retention, and 19x larger likelihood of profitability if they have robust data strategies.

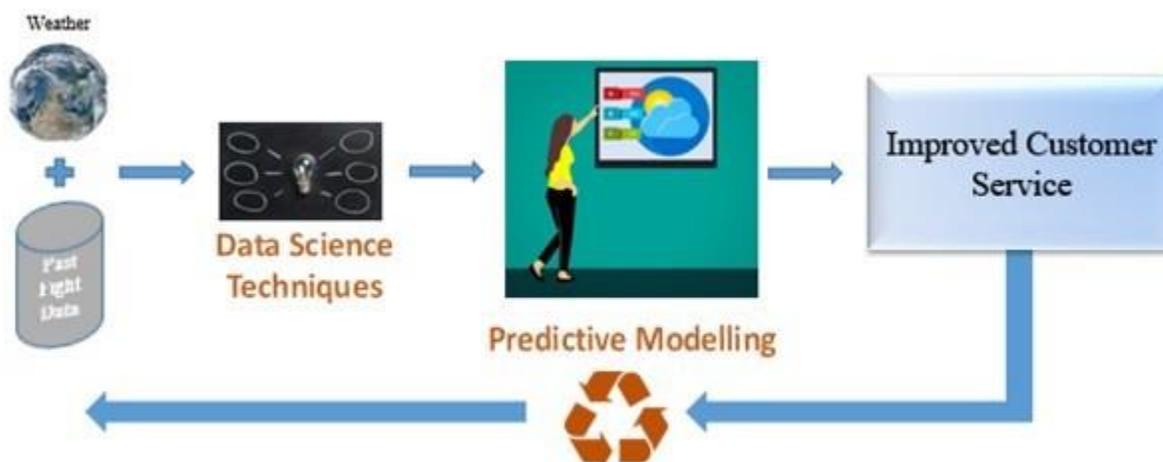
Few strategies that can leverage huge amount of data collected by the airline companies to improve on their bottom line :

Disruption & Recovery

Airline companies have a tremendous amount of past data about flight delays and can easily source the weather data from various other portals. Combining the two sets of data sources can help the companies better plan for the upcoming delays if any, in-flight departures or arrivals.

An instance of benefiting from such information, a storm in western parts of Ireland can be expected to pass through the UK in a day or two and depending on its intensity can disrupt flight schedules in one of the busiest airports of the world, London Heathrow. The airlines can inform passengers about the upcoming delay due to the storm a day or two in advance and so that the passengers can make necessary arrangements based on the purpose of their travel. An executive may reschedule a meeting in advance thereby saving from a lost business opportunity or a tourist may postpone its hotel booking for the destination. The result is an extremely satisfied customer and hence, repeat business.

The above is one example of using weather data to prepare well in case of a disruption. This can also be accomplished by combining with other data sources like unrest at the destination of travel, date & time of the travel. Thereby, providing enhanced customer experience.



Rescheduling Opportunity

A study has shown that the cost incurred in acquiring a new customer is 7 times more than the cost of keeping a customer. Also, with huge competition that the industry faces each player is surviving on bleak profit margin. Hence, it is very important for airlines to reduce customer churn in a market where the price is the most important parameter for the majority of the customers to switch the service provider.

At present, the cancellation or rescheduling charges of a flight are pretty high for a customer who books a flight well in advance to save some extra bucks. A user who has booked his flight 30 days in advance has more probability of rescheduling the flight nearer to travel date than a user who books close to the departure date. Majority of the users who book in advance are the ones who want to take advantage of low cost by early booking. Currently, the price of rescheduling is almost equal to the price at which the user originally bought the ticket (Ref. Image below for one such example). This serves as a discouragement for the user to reschedule the flight in case of any changes in the itinerary.

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Cancellation fee- 120% of booking amount **Rescheduling fee- 93% of booking amount**

Image Source: Goibibo Website

The airlines can, instead, keep the rescheduling charges low and thereby en-cash on the opportunity and score high on customer service. The way it works is, rescheduling fee rather than being a fixed amount should be variable and be proportional to the probability of the vacant seat being filled by another customer. This can be easily predicted using features like the consumer demand for the destination, past booking trends of the flight, number of vacant seats in the flight, origin of the flight, upcoming events in the destination city and such other parameters.

A high probability of the vacant seat being filled by another passenger can result in the same seat to be sold to a new passenger at a premium as the flight is in high demand and closer to travel date. The existing passenger pays a marginal amount for a new seat in another flight as it is closer to travel date. The airline generates revenue from both customers. In an industry where ticket prices represent 75% of operating revenue, sale of an

additional ticket contributes significantly to the top line. Moreover, it results in a win-win situation for airlines as well as the customers.

Hassle-free procedures

The time spent by the customer in check-in and check-out procedure at the airport adds to the travel time and can sometimes be more than the travel time. Airlines can drastically improve on the customer experience by providing a smooth transition and reducing the waiting time at the source and destination airports.

For instance, an artificial intelligence technology using facial recognition can help to ease the check-in process by comparing the photo in the passport with the actual image of the customer. The data can also be linked to the check-in baggage thereby making the collection of the baggage simpler at the destination airport. This also eradicates the chance of customers picking up the wrong baggage at check-out. It also improves the security at the airport by mapping the baggage to the customer in case of any prohibited items in the bags.

As convenience is the king in today's world, smart concierge services, powered by Artificial Intelligence (AI) have become a necessity for enhanced customer experience. At the moment, only when the flyer arrives at the airlines counter is when the flyer is tracked for boarding. With the help of intelligent systems, the airlines can be part of the customer journey even before the flyer arrives at the airport for boarding. The flyer can receive dynamic updates about the queue at the boarding pass collection counter or the security counter. The customer can also, if wishes to, check and make any last-minute changes to his flight. Fe of those could be -

- Check & buy additional baggage allowance
- Order a special meal on-flight
- Inform the airlines if there is a delay in reaching the airport
- Checking the boarding gate number

Tailored to Personal choices

A customer journey for an airline should not end with the traveler reaching its destination. It continues much post the travel. According to a study, 90% of travelers post about their travel experience on one or the other social media platform. This presents a good opportunity for airlines to analyze their brand loyalty. Sentiment analysis of the data collected from the social media platforms can help airliners to improve upon their overall customer experience.

A step forward, real-time analysis of customer experience can be helpful for the airlines to improve their service on the fly. For example, a customer who was not happy with the overall travel experience on his first leg of the journey can be compensated by providing a free upgrade to business class for his next connecting flight. This kind of supplements will require data to be collected in real-time and provide a customized package to the flyer.

On similar lines, real-time bag tracking service can also be helpful and let passengers know if their baggage is misplaced or delayed. These data strategies will go a long way for airlines to build customer loyalty and improve their overall brand value.

British mathematician and scientist Alan Turing first looked into computing intelligence in 1950. In a paper called “Computing Machinery and Intelligence”, he suggested using a now-famous ‘Imitation Game’ to test a machine’s sentient capabilities, which eventually laid the groundwork for the development and discovery of artificial intelligence (AI).

Decades later, AI and its subsets – machine learning and deep learning – are set to influence the future of many sectors, including aviation. Over the last few years, AI has found a wide array of applications in the industry – from **ground handling services to airport security** and air traffic management (ATM) – and there is now scope for more.

This is the argument of the recently-published **FLY AI report**, which sets out key steps towards a stronger adoption of AI, machine learning and other digital tools in several areas of aviation. Released by the newly formed European Aviation High Level Group on AI, the paper draws upon expertise from key players in the sector. These include leader EUROCONTROL, the Single European Sky ATM Research (SESAR) Joint Undertaking, the International Air Transport Association, Airbus and Airport Council International’s European division.

Alongside debunking some myths around AI, the paper identifies the most promising areas for its uptake. It also features a ‘FLY AI Action Plan’ that outlines future measures to better integrate the technology in ATM and other segments of aviation.

The importance of demystifying artificial intelligence

“AI has been around for more than 60 years but has gained ground more recently, thanks to advances in computing and access to data,” comments SESAR JU executive director Florian Guillermet. “Machine learning and deep learning are helping to create applications that can learn autonomously and advise on complex problems. Aviation is no stranger to the virtues of AI.”

“The aviation industry has started to exploit the potential of machine learning algorithms on non-safety critical applications.”

In recent times the technology has gained traction in segments such as intelligent maintenance, engineering and prognostics tools, supply chains and customer services. The sector is now eager to find more applications for AI, with some European countries – particularly Ireland, Finland, Cyprus, Luxembourg, Sweden and the Netherlands – leading the way.

“The aviation industry has started to exploit the potential of machine learning algorithms on non-safety critical applications,” adds EUROCONTROL head of infrastructure division Paul Bosman. “Recently, significant effort has been put on adapting the current certification framework to the specific characteristics of AI applications. With AI, the industry’s focus on cybersecurity has also increased.”

Based on this assumption, the report aims to “demystify and accelerate the use of AI in aviation and ATM in particular”, says Guillermet. This field directly involves SESAR, which has been coordinating all EU research and development activities in ATM since 2007 and actively contributed to the production of the report. “We also looked at the future evolution in the use of AI,” he continues, “in particular with the development of joint human-machine cognitive systems.

On the other hand, EUROCONTROL has acted as leader of the project under the European Aviation High Level Group on AI. The group was formed during EUROCONTROL’s inaugural conference on AI that took place in May last year.

Where artificial intelligence can actually ‘fly’ in aviation

Guillermet explains that Europe has “a strong basis of expertise and knowledge to further develop AI for ATM”. Here, automation can help improve operational efficiency in different segments of aviation.

“For instance,” he says, “machine learning digital assistants can mine huge amounts of historical data to support human operators on the ground or in the cockpit to make the best possible decisions.”

Within this framework, the FLY AI report identified four areas where AI can help tackle current and future challenges. These are airspace capacity, which is rapidly running out in Europe, the climate change crisis, digital transformation and new levels of complexity in the integration of unmanned aircraft in an already overcrowded airspace.

“Machine learning digital assistants can mine huge amounts of historical data to support human operators on the ground or in the cockpit.”

“AI’s ability to identify patterns in complex real-world data that human and conventional computer-assisted analyses struggle to identify makes it extremely well-suited to the aviation sector,” says Bosman. “AI has the potential to transform aspects of the aviation sector, enabling ATM functions to be performed in entirely different ways in the future.”

Bosman also believes that automation can play a pivotal role in improving the industry’s environmental credentials. “By accelerating the digital transformation in terms of optimising trajectories, creating ‘green’ routes and increasing prediction accuracy,” he says, “AI could make a real difference to mitigating the environmental impacts of aviation, in addition to providing decision-makers and experts with new features that could transform the ATM paradigm in terms of new techniques and operating procedures.”

In addition, better use of data will help increase and improve predictions with more sophisticated tools, while also boosting the scalability, efficiency and resilience of the current ATM system. Lastly, the technology can enhance safety in segments such as cybersecurity, conflict detection, traffic advisory and resolution tools.

The FLY AI Action Plan and future steps

A key takeaway from the report is that stronger cooperation is needed to integrate AI in the existing aviation architecture. “The aim is to create an ecosystem involving industry, research institutes, start-ups, policymakers and all relevant stakeholders, in which all conditions are met to progress collectively on this,” says Guillermet. “No one entity can address it alone.”

In response to this need, the report's FLY AI Action Plan looks at the whole value chain from research to implementation and provides stakeholders with a call for action.

According to Bosman, the plan identifies six accelerators that will help achieve this purpose. "It is now critical that the community gets together," he adds. "A way forward would be to set up a community of practice."

"The aim is to create an ecosystem involving industry, research institutes, start-ups, policymakers and all relevant stakeholders."

The first step will be developing a "federated data foundation and AI-infrastructure" that will grant access to data and enable the creation of an AI aviation partnership. In addition, the European Aviation High Level Group on AI suggests launching specific aviation/ATM training, reskilling / upskilling programmes, change management, a knowledge-based toolbox, and European AI aviation/ATM master classes to share best practices. Awareness and demystification campaigns should also be included.

Meanwhile, the industry will also have to build an AI aviation/ATM community to attract future experts to the sector. This, Bosman concludes, will help consolidate community expertise.

Covid-19: can the ongoing crisis catalyse more automation in the future?

Both EUROCONTROL and SESAR believe that the ongoing coronavirus crisis could help foster automation in the industry despite the challenges that it is causing. "The crisis has shown the limits and significant efforts required when using the current manual approach or analytical tools to try to understand the impact of the crisis, predict and help business recovery," says Bosman.

"The crisis has shown the limits and significant efforts required when using the current manual approach."

Specifically, AI's reliance on historical data sets on which to train neural networks means that in the event of a second wave of the pandemic, using these data sets will help improve crisis response. "As a precaution in the face of such a risk, it makes sense to gather and store all possible data related to the virus and its impact. This is so that they can be used to develop new AI applications that could support the aviation industry in dealing with any future waves of Covid-19 or other pandemics."

In addition, Guillermet says that the pandemic is shining light on the importance of new technologies to help businesses through a crisis. "Mastering these technologies and accelerating our plans for a digital Europe sky will deliver an aviation operating environment, which is more resilient, scalable and economically and environmentally sustainable in the long run," he says.

"Because aviation is one of the industrial sectors most impacted by the coronavirus pandemic, it should further accelerate the adoption of AI," Bosman concludes. "AI can really help transform the industry, provide better decision-making tools, and improve industrial and operational efficiency."