OAG

TRAVEL TECH REPORT 2024

THE FUTURE OF INNOVATIVE AIRLINE OPERATIONS

ABOUT OAG

Every day we at OAG help businesses across the world grow and innovate with access to high-quality travel data. Our mission is to help the travel ecosystem thrive by capturing the power of its data. Today's complex and competitive industry is our biggest adventure yet. With thousands of airlines and airports serving billions of travelers, the pressure is on from all sides: passenger demand, consumer expectations, regulatory complexity, the experience economy, and the drive for personalization. The propelling force in our industry has always been ground-breaking technology. We're built on it - powering frictionless travel in a data-driven world.

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THIS REPORT

In our continuous quest for innovation and providing valuable insights to the aviation industry, we are proud to present this in-depth report focusing on pivotal operational aspects of the airline business.

Our goal is to offer an analytical perspective, shedding light on the technological advancements that are reshaping key operational domains of airlines. This endeavor is a natural extension of our ongoing mission to delve deep into the digital transformation of the airline industry, sparking informed discussions about both the immense opportunities and the significant challenges it encompasses.

We have meticulously compiled this report to highlight critical areas of transformation, thereby empowering industry stakeholders with essential insights. These insights are crucial to navigating the complexities of the modern travel landscape, enabling effective adaptation and strategic planning in an era of constant disruption.

With this report, we reaffirm our dedication to providing in-depth analysis and actionable intelligence, aiming to contribute to strategic decision-making processes and ultimately, to shape the future of travel.

CONTENTS

INTRODUCTION

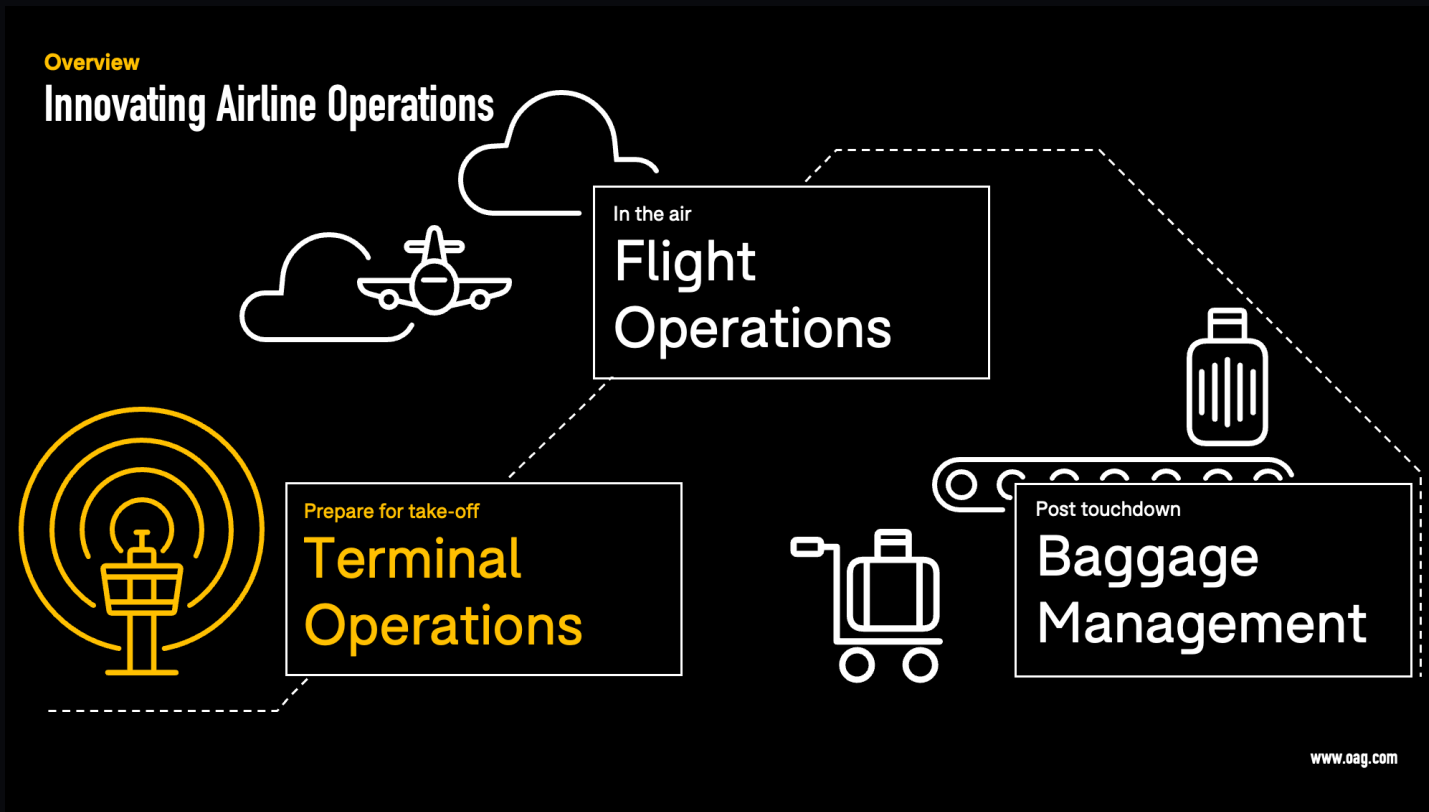
As the aviation sector continues its forward momentum, the transformative technology shifts aren't limited to just the airline retail experience we highlighted in our recent Airline Tech Transition Report.

There's another core segment of the airline ecosystem that's pivotal to its efficient functioning – airline operations.

Within the complex realm of airline operations, three pivotal areas stand out, each undergoing significant innovative overhauls that are reshaping traditional operational methods:

- **Ramp Terminal Operations:** Preparing the aircraft for its next journey.
- **Flight Planning:** Redefining operational excellence in the skies.
- **Post-Flight Operations:** Streamlined management of luggage post-landing.

In this report, we'll taker a closer look at all three of these critical areas, starting with Ramp Terminal Operations. We'll explore its nuances and understand its evolving role in the broader operational landscape of airlines.



INNOVATIVE AIRLINE OPERATIONS: THE TURNAROUND

In the aviation world, the clock is always ticking!

Each minute holds monumental value, especially when aircraft are grounded. As the famous airline saying goes: *planes don't make money sitting on the ground*. The essence of an efficient airline operation lies in how promptly it can prepare an aircraft for its next journey – all while maintaining the highest safety standards and ensuring top-notch service.

As the airline industry constantly evolves, so do the methods and technologies that support it. Today, the emphasis on efficient Ramp Terminal Operations isn't just about manual precision but about leveraging cutting-edge technologies to ensure seamless operations.

The intricate dance that constitutes Ramp Terminal Operations revolves around swift yet organized coordination. This process isn't merely about restocking amenities or refueling the aircraft. It involves orchestrating a multitude of stakeholders, for example, the strategic alignment between an airline's fleet planning, schedule planning, passenger reservations, in-flight and ground operations, and especially airplane maintenance systems. Furthermore, this coordination extends to interactions with external entities such as air traffic controllers, airport authorities, and control authorities like immigration and customs. These latter elements add significant uncontrollable factors to the process, contrasting with the aspects airlines can control. This dichotomy between controllable and uncontrollable aspects is a critical consideration in the efficiency and success of the turnaround process.

As a result of this complexity, a single turnaround typically consists of hundreds of individual tasks, involving more than 75 different people and entities.

So, what drives this push for optimizing turnaround times, especially in today's rapidly evolving aviation landscape?

Let's dive into the **three pivotal reasons** that are more urgent now than ever before, underscoring the importance of shaving off every possible minute from the aircraft turnaround process.

WHY MINIMIZING TURNAROUND TIMES IS PARAMOUNT

Before an aircraft embarks on its next journey, it undergoes a crucial period of preparation. First, it remains stationed at the gate, allowing passengers to disembark, cargo and baggage to be unloaded, and necessary services, including refueling, cleaning, catering, and maintenance to be performed. Following this, cargo and baggage are loaded afresh, and a new set of passengers board. The time this cycle takes, averaged over numerous trips, is what the industry denotes as **'average turn-time'**.

These average turn-times are constantly under pressure to be kept as short as possible.

Let's briefly explore why.

Summary

Three reasons why optimizing the aircraft turnaround is paramount

1 Save Money

Optimizing turnaround operations allows airlines to boost airplane utilization, ensuring planes spend more time flying. This improves cost efficiency by distributing fixed costs over more trips.

2 Happy Customers

Timely departures are crucial to passenger satisfaction. Efficient turnaround processes minimize delays, leading to improved travel experiences and higher loyalty.

3 Less Emissions

Reduced time on the ground means less use of the aircraft's Auxiliary Power Unit (APU), which in turn cuts down emissions. This is a step towards greener and more sustainable operations.

Source: OAG Analysis

1. THE ECONOMIC IMPERATIVE OF EFFICIENT TURNAROUND

For airlines, time is money – quite literally. An airplane on the ground is usually an asset not generating revenue. Thus, the quest for minimizing average turn-time isn't merely operational but fundamentally economic.

This is especially true for low-cost airlines that rely heavily on quick turnarounds for efficient operations. However, it's important to note that for many legacy carriers, the equation can be more nuanced. For them, scheduling optimal connectivity in their hub-and-spoke systems often takes precedence. Additionally, in some cases, aircraft may need to remain on the ground for extended periods due to time differences and specific flying patterns. Thus, while efficient turnaround is universally valuable, its impact and implementation can vary significantly between different types of carriers.

In the case of budget airlines, the foremost consideration is airplane utilization. Especially for carriers championing point-to-point routes and those with shorter average trip lengths, efficient utilization is a key necessity. Such carriers typically adopt a streamlined approach: they employ a simplified fleet structure, limit airplane types, and emphasize high airplane utilization.

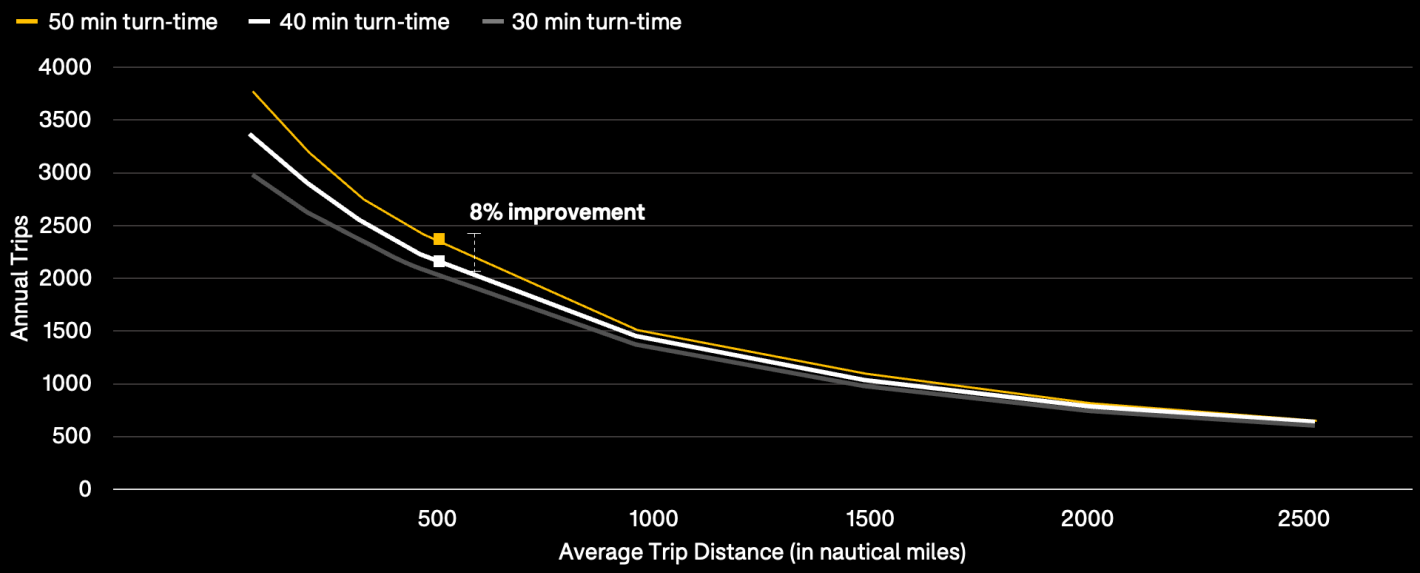
This lean operational model offers dual benefits:

- **Firstly**, with a limited variety of airplanes, swapping out an aircraft in case of unforeseen technical glitches becomes smoother.
- **Secondly**, elevated airplane utilization allows these airlines to distribute their fixed ownership expenditures across a larger number of flights, effectively diminishing costs on a per-seat-mile or per-trip basis.

Comparison

Small changes in turn-times have big economic impacts

Aircraft utilization based on different turn-times (in minutes)



Source: Boeing

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Boeing's research crystallizes the economic significance of reducing turn-times. By shaving off a mere 10 minutes from the average turn-time (reducing it from 40 to 30 minutes), airplane utilization surges by an impressive 8% for a typical point-to-point carrier.

While the advantages of decreased turn-times are clear, assigning an exact monetary value to such reductions is challenging. Grounding costs are influenced by a myriad of factors, from the specifics of aircraft financing and aircraft type to variables like route specifics, fuel prices, load factors, and more.

While it's challenging to pinpoint an exact financial figure, the economic rationale for minimizing turn-times remains unquestionable. As such, the push for enhancing efficiency in turnaround operations is primarily about profitability.

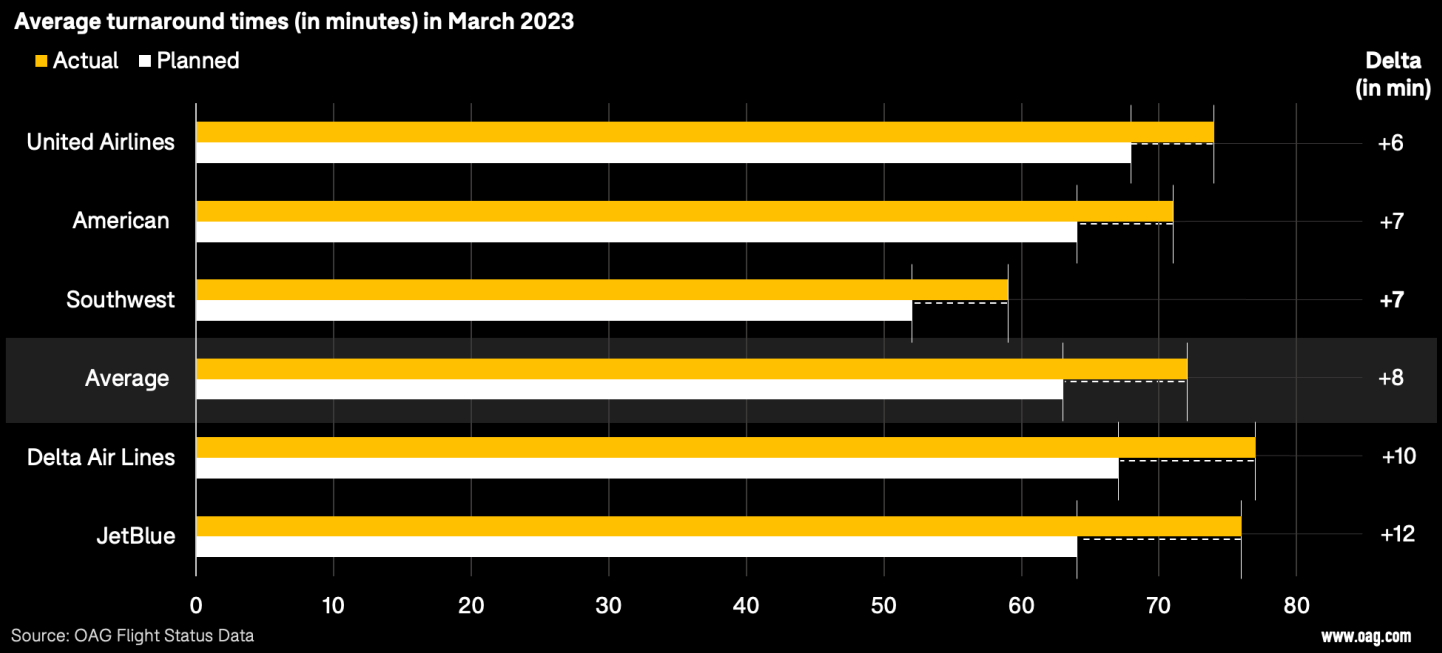
2. THE PASSENGER'S PERSPECTIVE ON TURNAROUND TIMES

While airlines grapple with the economics of turnaround times, passengers are primarily concerned with another facet: punctuality.

Punctuality is not just about the flight departing and arriving on time. For many travelers, especially those on connecting flights, punctuality is crucial for ensuring connectivity. A delay in one segment can have a ripple effect, potentially causing passengers to miss their connecting flights and disrupting carefully planned itineraries. Therefore, maintaining strict adherence to scheduled turnaround times is essential not just for economic reasons and operational efficiency but also for ensuring that passengers can reliably reach their destinations or make their connecting flights without undue stress.

Ranking

Turnaround times are often longer than originally planned



According to our proprietary **OAG Flight Status Data**, while a delay of about six minutes in planned turnaround can **often be recuperated** at some stage during a flight, anything beyond this window typically culminates in agonizing delays.

Data from our **OAG analysis in March** 2023 provides the regularity of this issue.

- Alarmingly, none of the major US airlines consistently achieved their aircraft turnarounds within the projected timeframes.

- United Airlines was the lone contender that managed to keep the variance within the six-minute gap between planned and actual turnaround times.

Our findings from March, while indicative, represent only a high-level view given the small sample size of 10 airports and 25 airlines. However, they do align with larger industry trends observed across various markets. According to the 2023 **Turnaround Benchmark Report**, the average ground delay, even among the best-performing short-haul airlines in the world (categorized as those in the top 75th percentile in terms of turnaround time), is an alarming eight minutes. This statistic highlights the significant challenges that even the most efficient airlines face in optimizing turnaround times.

What does all this mean for the average traveler?

Simply put, disruptions and discomfort.

- Recent studies indicate that flight delays feature prominently among **the top three frustrations** that air travelers complain about.

- Frost & Sullivan estimates that a 1% reduction in on-time performance in a given year results in a reduction of up to 0.6% of an airline's net promoter score.

Thus, streamlined and punctual turnaround times aren't just an economic necessity – they're a core pillar of customer satisfaction. This holds true for all carriers, spanning the spectrum from short-haul point-to-point providers to long-haul legacy specialists.

3. THE GREEN ANGLE OF TURNAROUND TIMES

The call for sustainability is bellowing louder than ever, especially in the airline industry.

As stakeholders and passengers push for a "greener" travel experience, airlines are compelled to scrutinize every facet of their operations, from in-flight procedures to on-ground activities.

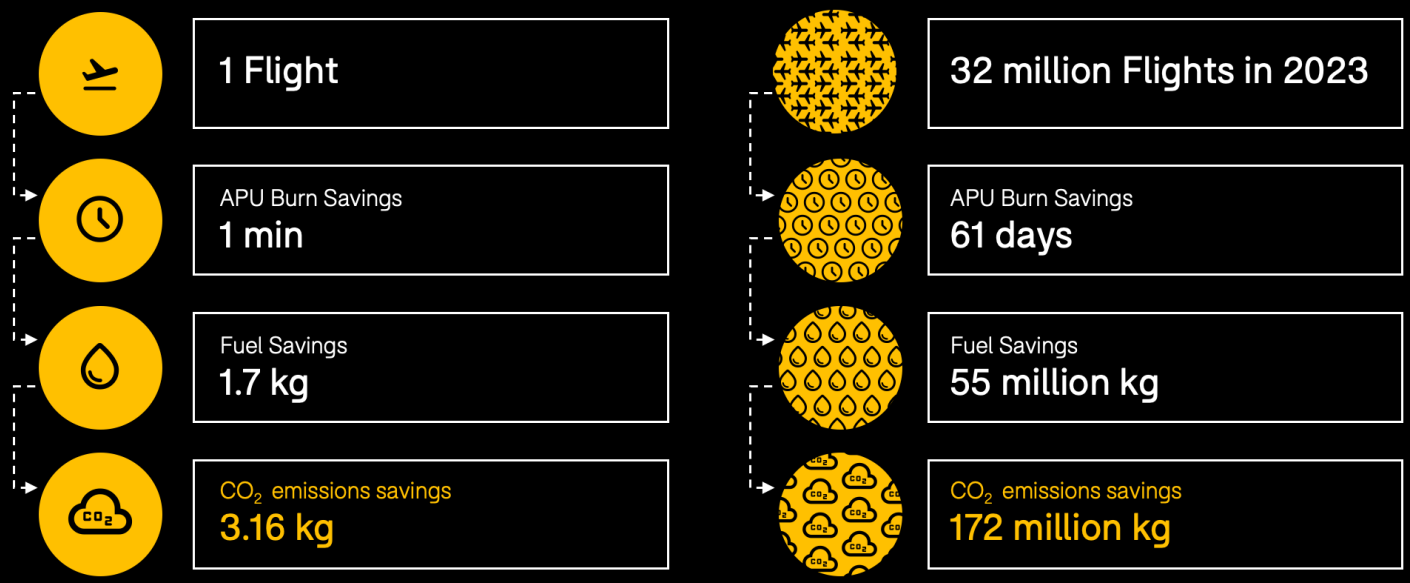
While the main engines might be silent during the turnaround, the aircraft is far from inactive. An essential player here is the aircraft's Auxiliary Power Unit (APU), typically nestled in the tail cone. Even with the main engines switched off, the APU runs, providing vital electrical and mechanical power. This includes maintaining air conditioning, powering essential cockpit systems, and eventually aiding in restarting the main engines.

While the APU serves a pivotal role, it's not without its environmental footprint. Every minute of delay in turnaround times adds

Projection

The impact of one-minute faster turnaround times on CO2 emissions

Exemplary



Source: OAG Analysis, Assaia Turnaround Benchmark Report, IATA Flight Projections

to the APU's operational duration. While the emissions might seem minor in isolation, they accumulate rapidly.

- Reducing each flight's turnaround time by just a single minute, thus cutting APU runtime, can lead to a **CO2 reduction of over 3 kg** – a seemingly modest amount.

- But when projected across the anticipated **32 million flights in 2023**, this translates to a staggering industry-wide savings of over 172 million kg of CO2.

Recent research supports this savings potential:

- The **Turnaround Report** finds out that among the 25% least efficient airlines in terms of turnaround management, an average of 16 minutes of additional APU operation equates to a burn of approximately 27kg of extra fuel, translating to over 85kg of additional CO2 emissions.

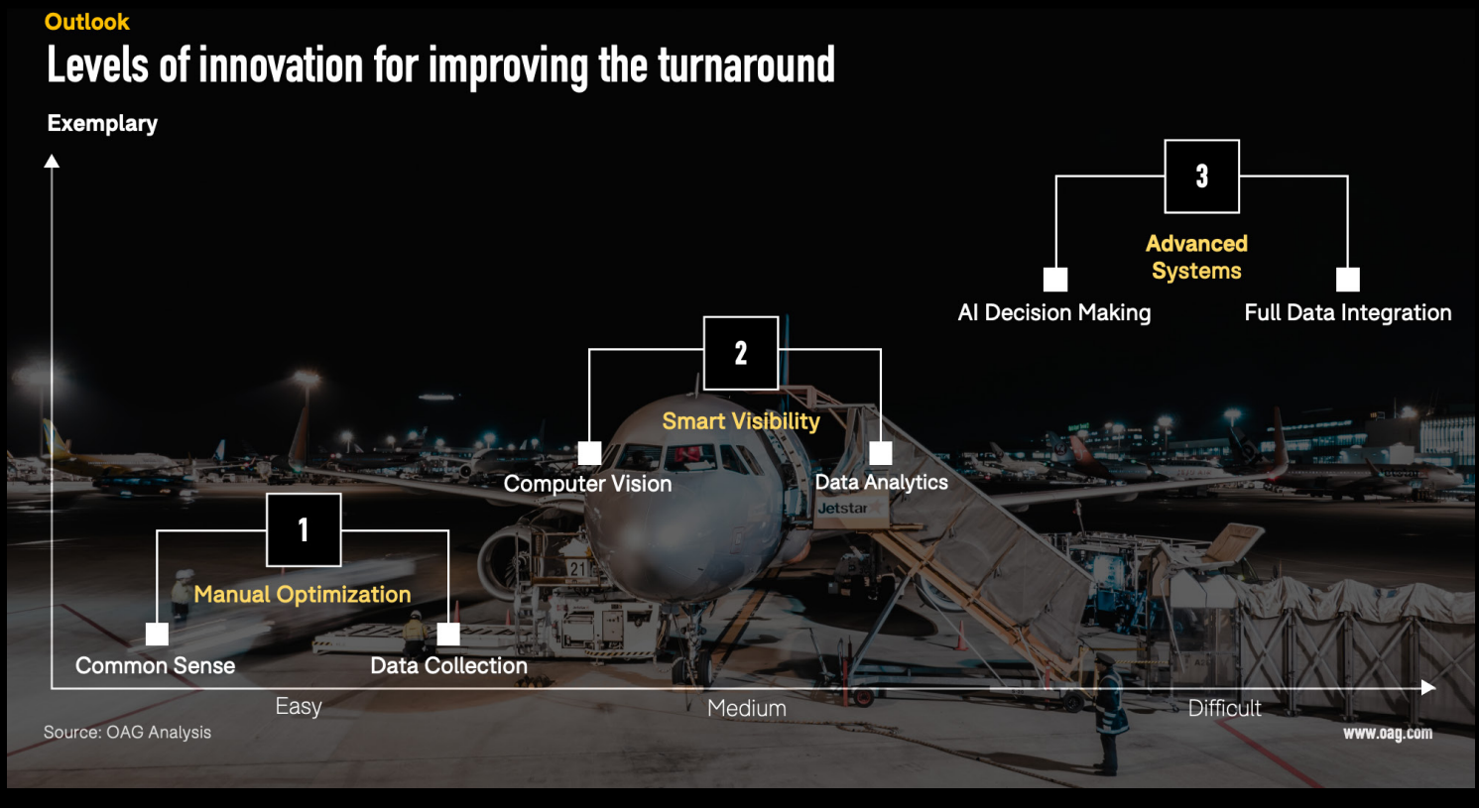
- This **Transport and Environment Study** illuminates that accurate departure time forecasts would significantly trim down unnecessary APU emissions, reinforcing the importance of a tight turnaround schedule.

Notably, this carbon footprint could be effortlessly sidestepped if turnaround times adhered closely to the plan – no revolutionary electric or hydrogen-based jet engine needed.

So while many view sustainability through the lens of in-flight practices only, the significance of ground operations cannot be ignored. After all, every saved minute on the ground is a stride toward a greener tomorrow.

Outlook

Levels of innovation for improving the turnaround



THE TECH BEHIND PERFECTING TURNAROUND TIMES

To appreciate the transformative potential of faster turnaround times, it's vital to evaluate how these improvements can be realized consistently and safely. The fusion of innovation and technology is the keystone to this advancement. This journey of innovation unfolds in three distinct phases:

1. MANUAL OPTIMIZATION

At its core, this is about refining and rigorously standardizing turnaround processes. A consistent and clearly defined approach to turnaround processes like cleaning, cargo handling, and passenger boarding can significantly smooth operations. The more these processes are repeated, the more streamlined they become. This is when little windows of opportunity for improvement show up.

One compelling example showcases Delta Airlines' awareness: it tweaked the angle at which aircraft are pushed away from the gate. A shift from 90 degrees to 45 degrees saved the company just a minute or two each time, but these small increments, over time, prove monumental, as we learned above.

There are many other straightforward ideas to augment this efficiency further. While these manual optimizations are invaluable, they offer only limited upside potential. For more transformative shifts, technology-led innovation is imperative.

2. SMART VISIBILITY

This second phase is anchored in leveraging today's technology to keep a vigilant eye on ongoing processes and to enhance planning. A notable example is AeroCloud, which boosts its Airport Management

Systems by combining flight data from multiple sources. This ensures a real-time, up-to-date single source of truth around flight activities, facilitating better planning for upcoming turnarounds.

Employing computer vision allows for real-time operational monitoring, flagging any deviations from optimal performance. Springshot is such a case in point. Developed in 2011, Springshot is an operations platform that provides aviation managers and planners with a unified control panel for smooth daily operations. By integrating our OAG data, Springshot equips airports and airlines with tools for accurate and balanced resource distribution. Its systems, fueled by automation, integrations, and AI, help save millions of dollars by preventing delays.

Assaia, a travel-tech startup from Switzerland, is another powerful example. The company's partnership with airports, like the one in Halifax, Canada, employs a synergy of Artificial Intelligence and computer vision. Its solution can, for example, assist in efficient de-icing processes, a frequent cause of delays. By integrating data from the gates, the de-icing pad, and other essential inputs, the technology facilitates better coordination, minimizing blockages. Assaia's tech suite, with its real-time alerts and event detection capabilities, claims over 12% turnaround time improvements.

Other tech giants, including IBM, have also channeled their expertise into the turnaround domain, creating unified platforms to enhance collaboration and streamline operations. An array of tech solutions, from emerging startups like Aerogility and EXSYN to long-time tech pioneers like Honeywell and IBS Software, are also making waves in this space. Not to mention airline-owned solutions such as those from Lufthansa Systems.

What all these examples have in common is that they lie at the intersection of data, people, and technology, making sense of the data and connecting the right people.

3. THE AI-DRIVEN FUTURE

The journey of innovation in airline operations is steadily integrating AI technologies, not only for monitoring and detecting but also for proactive adjustments that enhance operational efficiency.

A prime example of this unfolding AI future is the "Deep Turnaround" system at Amsterdam Schiphol Airport (AMS). This AI-driven solution, equipped with cameras, tracks over 70 steps in the aircraft turnaround process to predict its duration and estimate when a plane is ready to push back from the gate. Although still in its early stages, "Deep Turnaround" has already shown positive results and is not limited to Schiphol. Recently, it was revealed that this system is also being tested at other airports, including Eindhoven Airport.

With this in mind, imagine the expansive potential of such technology. For instance, an AI system could use real-time weather updates to foresee delays and automatically redirect fuel or cargo handling to another aircraft due for an imminent departure. This proactive adaptation ensures no time is wasted, resources are optimally utilized, and the integrity of the flight schedule is maintained. These advancements signal a future where AI not only tracks and reports but dynamically orchestrates operational

decisions, leading to more efficient, timely, and sustainable airline operations.

This future vision underscores a seamless, automated ecosystem where every piece of data is not just collected but also actioned upon in real-time, ensuring optimal turnaround efficiency.

In wrapping up, it's clear that the most effective solutions for airlines emerge from the synergy of innovation, data, and technology. These elements serve as invaluable aids to dispatchers and movement controllers, offering enhanced visibility and informed decision-making. However, it's important to recognize that while these advancements significantly assist operational processes, they are not replacements for human insight. Commercial considerations and other critical factors still require human oversight and intervention.

As the airline industry continues to evolve, the adept management of turnaround times, augmented by these technological aids, will play a crucial role in determining its future course and success.

INNOVATIVE AIRLINE OPERATIONS: FLIGHT PLANNING

Overview

Innovating Airline Operations

As the aviation industry propels into a future marked by rapid technological advancements, innovation is reshaping not just the retail side of aviation (as we highlighted in our Airline Tech Transition Report), but the very core of airline operations.

For example, advancements in the digital transformation of aircraft turnarounds are contributing to improvements in terminal operations as we just learned in chapter one.

Another critical element within the vast machinery of aviation operations is **flight planning**. Here, innovation is not just a buzzword but a relentless pursuit, encompassing a range of technologies poised to redefine operational excellence and efficiency in the skies.

Today, airline dispatchers within Network Operations Centers collaborate closely with pilots to ensure safe and efficient routing. Using mainly legacy airline computer systems, their task is to navigate a myriad of factors, including weather forecasts, air traffic, and aircraft performance, all while adhering to safety and air-traffic control compliance.

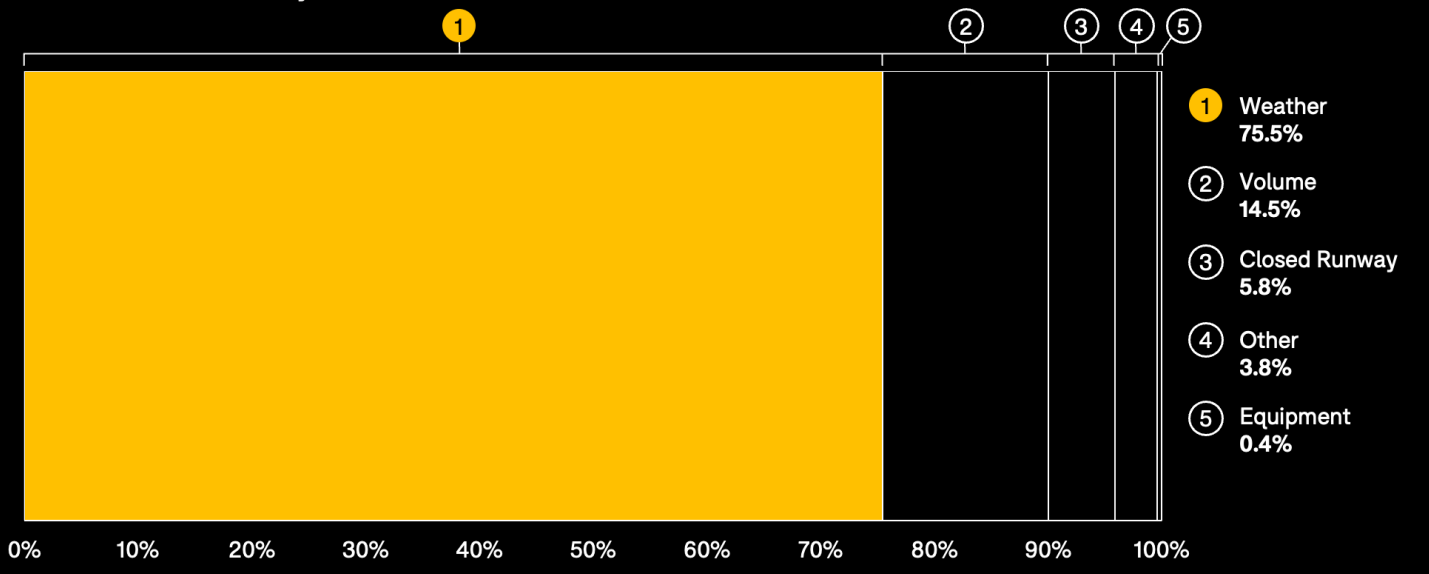
While this setup has long ensured efficient operations, there's an emerging need for more integrated technology solutions that can enhance the precision and adaptability of flight planning, making the process more responsive to the dynamic aviation environment, as we will uncover below.

As part of this analysis, we will address the pressing challenges that require improved flight planning and spotlight several groundbreaking airline use cases. These examples, driven by data and technology, are pioneering new approaches to flight planning with remarkable effectiveness.

Driver #1

Three quarters of all flight delays are caused by weather conditions

Reasons for air traffic delays in the U.S. between 2017 and 2022.



Source: Federal Aviation Administration, OPSNET

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To get started, let's focus on the very basics of flight planning. For flight operations, two key challenges dictate the rhythm: weather conditions and air traffic.

Both of these elements have become more complex to manage over the past few years.

1. MORE SEVERE WEATHER CONSIDERATIONS

The weather stands as an ever-present factor influencing flight schedules. Its unpredictable nature requires constant monitoring and adaptability. Statistically, weather plays the most significant role in operational disruptions. The FAA reports that over the last five years, weather conditions have accounted for nearly three-quarters of all flight delays in the United States.

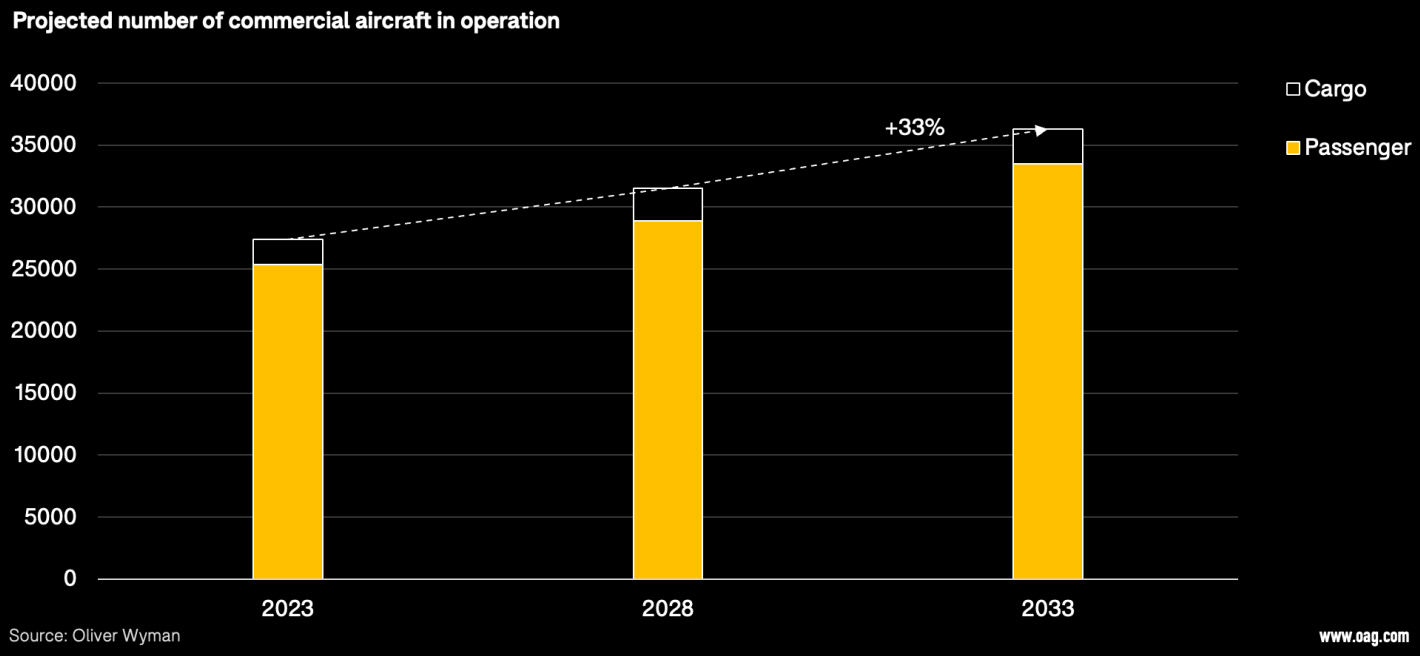
Extreme weather not only causes delays but can severely interrupt entire flight schedules. A recent example is Munich Airport, which had to suspend all flights during the first December weekend due to snow chaos in large parts of Southern Germany.

When weather disturbances are transient or localized, effective airspace management can usually mitigate their impact. However, the evolving climate crisis has led to more extreme and widespread weather phenomena, necessitating advanced airspace management strategies and next-generation systems to adapt and respond.

One study found that the airline industry loses $13,000 USD every time a flight is canceled because of an uncontrollable weather event.

Driver #2

Our skies will become a lot busier over the next ten years



2. THE IMPACT OF GROWING AIR TRAFFIC

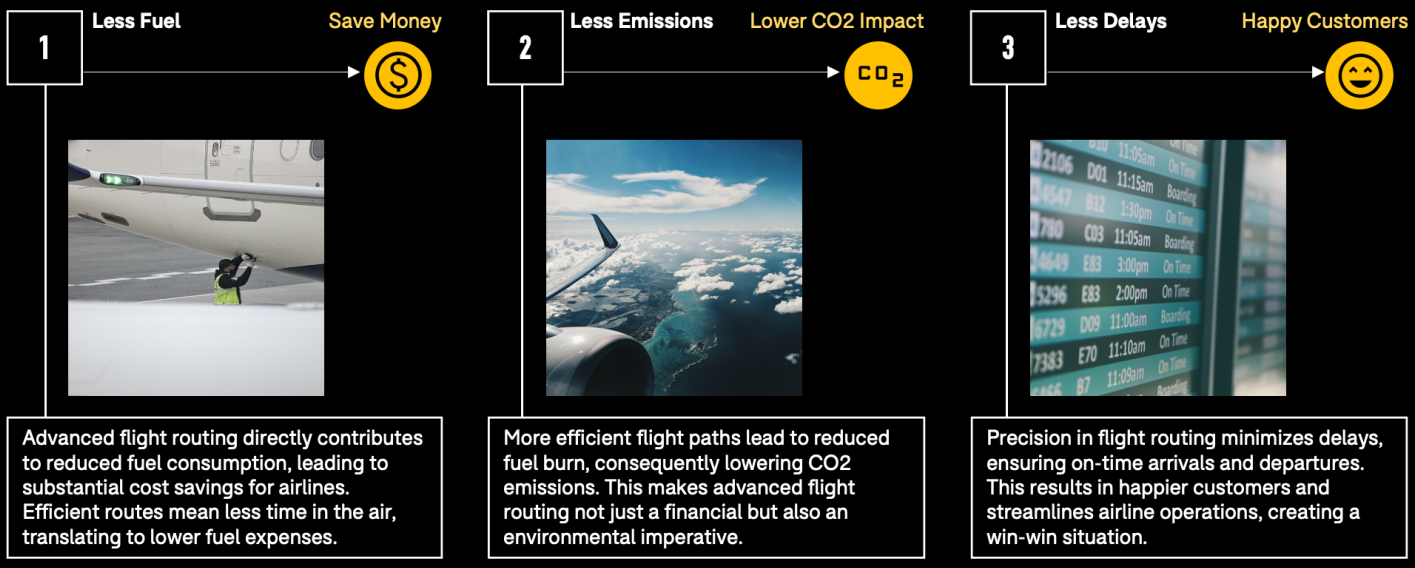
The second critical factor influencing flight planning is the surge in air traffic. Although the pandemic temporarily halted this trend, air travel is swiftly rebounding to almost pre-pandemic levels, as highlighted in our OAG COVID-19 Air Travel Recovery tracker.

Looking into the future, even moderate projections suggest a 20-30% increase in air travel demand by 2030 compared to 2019 figures. As a result, the global commercial aviation fleet is expected to expand by about one-third, reaching over 36,000 operational aircraft by the early 2030s, according to Oliver Wyman.

This significant uptick in air traffic intensifies the complexity of flight planning. It calls for more sophisticated systems to manage the burgeoning number of aircraft, including the integration of cargo flights and potentially even cargo drones. Moreover, route restrictions from Air Traffic Control (ATC) and regulatory constraints are likely to become more prevalent. Recent innovations, such as continuous descent approaches, high-altitude redesign in the western U.S., and new FAA ETOPS rules, indicate the evolving nature of airspace management. These constraints, coupled with the sheer scale of the calculations involved, present a “formidable challenge in optimization, even with today’s advanced technologies,” according to Boeing.

Summary

Three compelling reasons for Advanced Flight Planning



Source: OAG Analysis

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ADVANCING FLIGHT PLANNING: THE TECH FOR CHANGE

The creation of a flight plan marks the beginning of every commercial airline flight, and the optimization of this plan is essential. It involves dynamic route optimization, accurate flight planning, efficient redispatch use, and dynamic airborne replanning.

While all airlines deploy computerized flight planning systems, those willing to invest in next-gen systems can significantly enhance customer satisfaction, profitability, and environmental sustainability. As the aviation sector evolves, such advanced systems leverage the power of Artificial Intelligence (AI), which is playing an increasingly pivotal role in aviation. Its capacity to process and analyze vast amounts of data, identify patterns, and offer real-time predictions is transforming flight route planning as we know it.

Recent advancements in AI and deep learning have further advanced capabilities and led regulatory bodies like the FAA and EASA to assess AI's potential application in various use cases in aviation.

Here are a few of the significant application areas directly related to flight routing and planning:

- Next-generation AI platforms utilize traffic information based on scheduled and active flights to formulate flight paths that dodge congested zones and adverse weather conditions, thereby minimizing delays. One such innovator, AVTECH, empowers airlines and air traffic control to optimize air traffic flow by integrating atmospheric conditions and precise aircraft positioning data. This not only reduces delays but also cuts fuel consumption, lowers emissions, and boosts punctuality.

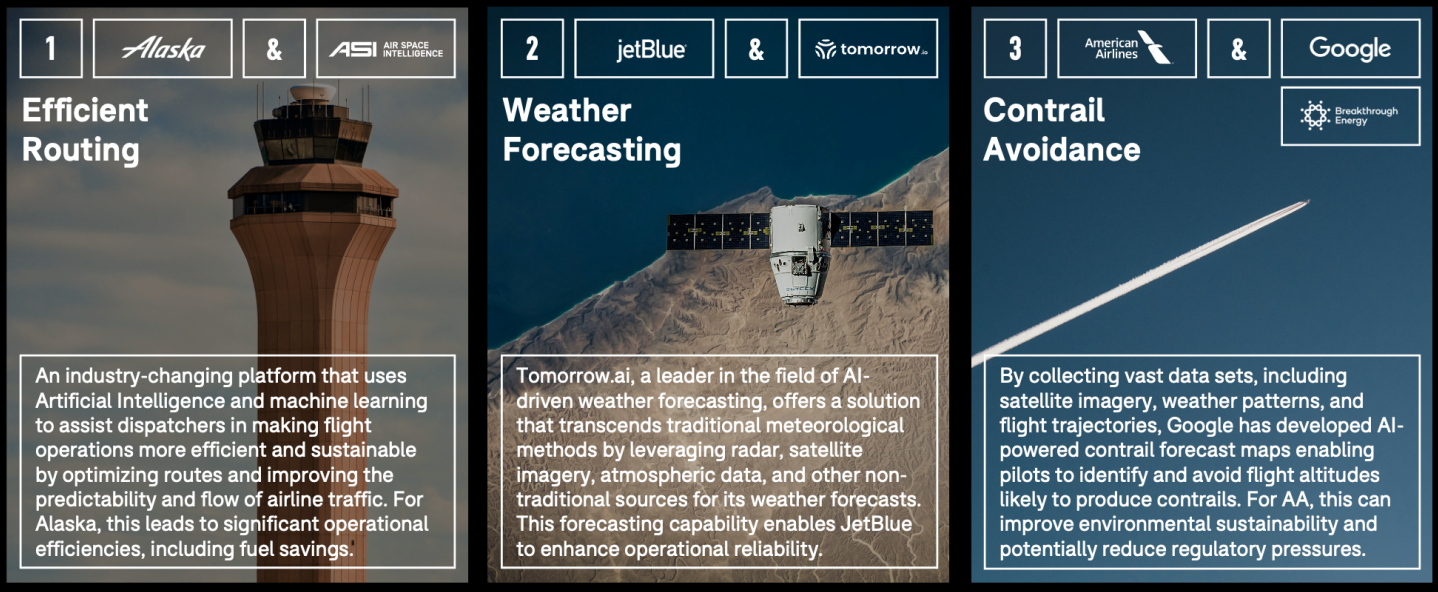
- AeroCloud's **Flight Management System** is another exemplar, aggregating data from diverse sources, including ADS-B, to provide accurate, real-time flight information. Air traffic management solutions from companies like **Saab** and **Air Space Intelligence (ASI)** blend machine intelligence and user-friendly design to aid dispatchers, flight crews, and network managers in enhancing flight safety, efficiency, and sustainability.

- Weather radar technology, too, is undergoing a radical transformation. One example is Honeywell's **IntuVue 3-D Weather Radar**, which extends turbulence detection up to 60 nautical miles and predicts hail and lightning.

- **Project Bluebird** stands as another beacon of innovation in this field. This research initiative aims to develop the world's first AI-based system to collaborate with human air traffic controllers in managing UK airspace sections. It employs machine learning techniques, such as reinforcement learning, to assess air traffic control algorithms, predict flight trajectories, and identify potential aircraft conflicts. This data is crucial for strategic airspace planning and real-time decision-making support for ATC personnel.

Summary

Partnerships between airlines and tech players



Source: OAG Analysis

AIRLINE USE CASES ADVANCING FLIGHT PLANNING

In the quest for optimal flight planning, airlines are increasingly turning to the power of AI and Machine Learning (ML). We will now explore three compelling use cases from different airlines. These examples serve as a testament to the innovative spirit pervading the airline industry and its commitment to embracing cutting-edge technology.

CASE STUDY #1: ALASKA AIRLINES' PARTNERSHIP WITH AIRSPACE INTELLIGENCE

In a pioneering move, Alaska Airlines has teamed up with San Francisco-based startup Airspace Intelligence to employ its platform, Flyways AI. This collaboration marks a turning point in the context of advanced flight operations, harnessing the potential of AI and ML for enhanced flight routing.

Unlike traditional methods focusing on individual flights, Flyways AI views air traffic as a dynamic, interconnected ecosystem. It continuously analyzes all scheduled and active flights across the U.S., identifying optimal routes that avoid turbulence and congestion. The platform's recommendations are not prescriptive but rather suggestive, empowering dispatchers with helpful options. The final decision to adopt these recommendations remains with the dispatchers, ensuring compliance with FAA protocols and operational safety. Alaska Airlines' adoption of Flyways AI is a testament to its commitment to innovation and sustainability, with tangible impacts paying off:

- According to the airline, within the first six months of testing Flyways AI, the system identified potential reductions in mileage and fuel usage for 64% of Alaska's mainline flights. Of these, dispatchers implemented 32% of the recommendations — a significant share, showing how much airline dispatchers value the AI-driven insights and efficiency gains offered by the system.

- As a result, in the same time frame, this initiative led to a substantial saving of 480,000 gallons of fuel, consequently avoiding 4,600 tons of carbon emissions.

- Impressively, between January and September 2022, Flyways AI contributed to an average time saving of 2.7 minutes per Alaska flight. While this might seem modest at first glance, it's a significant stride in enhancing on-time performance, a critical factor in passenger satisfaction.

CASE STUDY #2: JETBLUE'S ADVANCED WEATHER FORECASTING WITH TOMORROW.IO

JetBlue's testing of Weather Tech, in partnership with Tomorrow.io, marks another powerful stride in optimizing flight planning.

Tomorrow.io, a leader in the field of AI-driven weather forecasting, offers a solution that transcends traditional meteorological methods by delivering hyper-accurate, location-specific forecasts in real-time, leveraging radar, satellite imagery, atmospheric data, and other non-traditional sources to generate weather forecasts. The platform enables airlines to anticipate and adapt to rapidly changing weather conditions much more accurately. The standard in weather forecasting has long relied on classical meteorologists and government data, which often lack the granularity and immediacy crucial for the airline industry, especially when it comes to predicting winds and lightning with enough specificity. Tomorrow.io's approach, however, tailors its forecasts to meet the more demanding needs of aviation, providing actionable insights that are both precise and timely.

JetBlue's integration of Tomorrow.io's technology at all of its ten major airports across the U.S. has yielded noteworthy operational improvements:

- Tomorrow.io's forecasts have enabled JetBlue to avoid weather-related disruptions, leading to considerable cost savings. JetBlue estimates a monthly saving north of $300,000 USD across its hubs, amounting to an annual reduction in operational costs of close to $4 million USD.

- With real-time, accurate weather data at their fingertips, JetBlue's operations teams can make faster, more informed decisions. This efficiency translates to fewer delays and cancellations, directly impacting customer satisfaction.

JetBlue's partnership with Tomorrow.io exemplifies how specialized AI solutions, in this case, Weather Tech, can enhance aspects of airline operations that have traditionally relied on less sophisticated methods.

CASE STUDY #3: AMERICAN AIRLINES AND GOOGLE MITIGATE CONTRAILS

In a groundbreaking initiative, American Airlines joined forces with Google and Breakthrough Energy, targeting an often-overlooked yet significant environmental issue in aviation: contrails. This collaboration aims to reduce the warming effects of aviation, demonstrating a commitment to sustainability that extends beyond traditional emission reductions.

Contrails, which are short for condensation trails, are cloud-like trails that aircraft leave in the sky. While they might seem harmless, they have a substantial impact on the environment. The 2022 IPCC report highlighted that contrails account for approximately 35% of aviation's warming effect, a significant figure that underscores the importance of addressing this issue.

By collecting vast data sets, including satellite imagery, weather patterns, and flight trajectories, Google has developed AI-powered contrail forecast maps. These maps enable pilots to identify and avoid flight altitudes likely to produce contrails. In a series of 70 test flights over six months, pilots utilized Google's AI-based predictions alongside open-source contrail models from Breakthrough Energy. The objective was clear: to minimize the formation of contrails without compromising flight efficiency.

The results of this experiment are nothing short of impressive:

- Post-flight analysis revealed a significant reduction in contrail formation. Pilots successfully reduced contrail occurrence by 54%, marking a significant milestone in mitigating aviation's climate impact.

- This initiative marks the first verifiable instance where commercial flights have actively and effectively avoided contrail formation, thus setting a precedent for the industry and showcasing the impact of next-gen flight route planning beyond cost savings.

NAVIGATING TOMORROW: AI'S ROLE IN AIRLINE OPERATIONS

Flight planning is crucial in airline operations, and the integration of AI-powered models is revolutionizing this aspect. These technologies enable airlines to make more informed decisions, improving efficiency, sustainability, and passenger satisfaction.

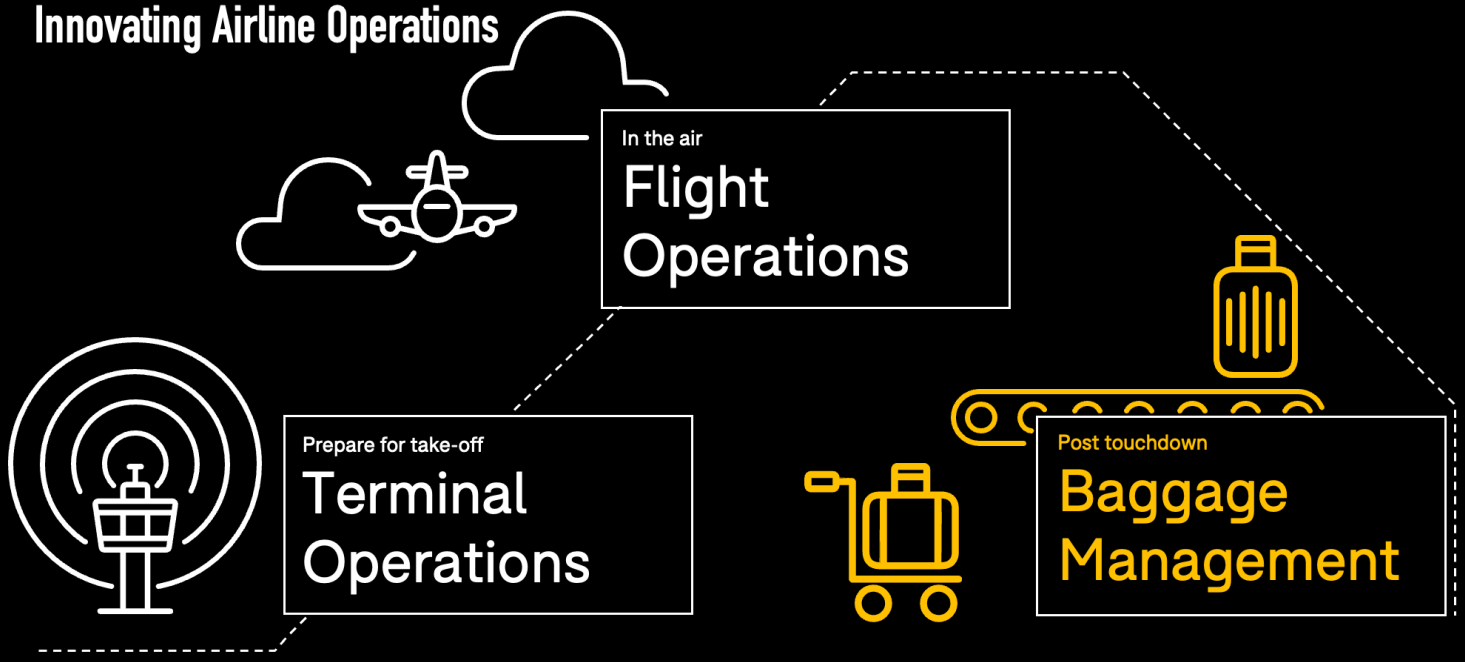
Our case studies demonstrate how AI and ML can be used to optimize flight routes, predict weather patterns, manage air traffic, and even reduce environmental impacts like contrail formation. This is not just about operational efficiency; it's about advancing towards a more sustainable and passenger-centric future.

In this evolving landscape, accurate data is key. At OAG, we pride ourselves on offering the most comprehensive flight, airline schedules, and air logistics data, available in various formats, including APIs. We're at the forefront of this transformation, providing the tools and insights essential for navigating the future of aviation.

INNOVATIVE AIRLINE OPERATIONS: BAGGAGE MANAGEMENT

Overview

Innovating Airline Operations



Another vital component of the aviation operations ecosystem often escapes the limelight but is equally crucial to the industry's overall performance – **baggage management**. The handling of passenger luggage is a complex operation that demands precision, efficiency, and innovation.

Today, the baggage handling process is undergoing a transformative journey, driven by various factors, which we will uncover in this chapter. These advancements aim to optimize the entire baggage lifecycle, from check-in to final delivery, significantly reducing the chances of mishandling and enhancing the overall passenger experience.

We will examine the challenges faced, the innovative solutions being implemented, and the tangible benefits these advancements bring to airlines, airports, and, most importantly, to passengers.

STATUS QUO OF BAGGAGE MANAGEMENT

In the current baggage management system, upon an aircraft's arrival, baggage is usually unloaded and immediately categorized into local and transfer baggage. For some network carriers, baggage can also be pre-sorted and containerized via Unit Load Devices (ULDs) based on whether it's local or connecting. Local baggage, unless required to pass through customs, is promptly transported to the baggage reclaim area. Transfer baggage either makes its way to the sorting facility for routing to subsequent flights or, in cases where time is of the essence, a direct "tail-to-tail" transfer to the connecting aircraft is initiated.

Beyond the multiple steps involved, tail-to-tail transfers are notably labor-intensive. This process requires individual deliveries

to specific aircraft stands, contrasting the more straightforward approach of depositing them at a nearby baggage induction point.

The entirety of this system, with its involvement of various stakeholders and the criticality of synchronized timing across all steps, faces increasing vulnerability when passenger volumes are high. Consequently, as more travelers take to the skies, the challenge of efficiently managing a greater volume of baggage intensifies, highlighting the fragility of the system, especially during peak travel seasons.

RISING MISHANDLED BAGGAGE RATES

In baggage management, the airline industry has consistently improved its handling efficiency, with the mishandled baggage rate decreasing to 0.6% of all passenger bags between 2016 and 2019. This rate further dropped to 0.35% during 2020, largely due to the drastically reduced passenger numbers resulting from global travel restrictions and the pandemic's impact on air travel.

However, as travel rebounded post-pandemic more rapidly than many expected, this positive trend unfortunately reversed. According to SITA's latest Baggage IT Insights report, the mishandled baggage rate escalated from under 0.5% of all passenger bags pre-pandemic to nearly 0.8% in 2022.

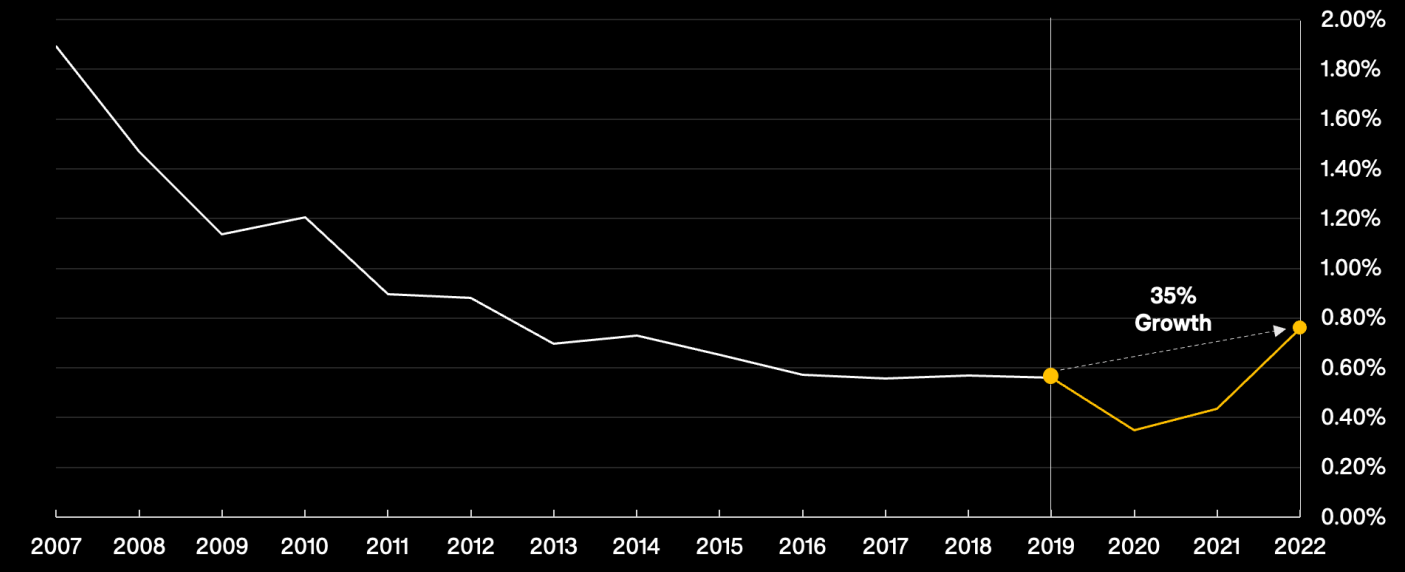
Breaking down these numbers, it's revealed that 80% of mishandled bags were merely delayed, while the remaining 20% were either lost or damaged.

It is important to note that the baggage-handling challenge becomes more acute in the context of connecting flights,

Trend

Baggage mishandling rates exceed pre-COVID levels

Share of mishandled bags per passenger



Source: SITA

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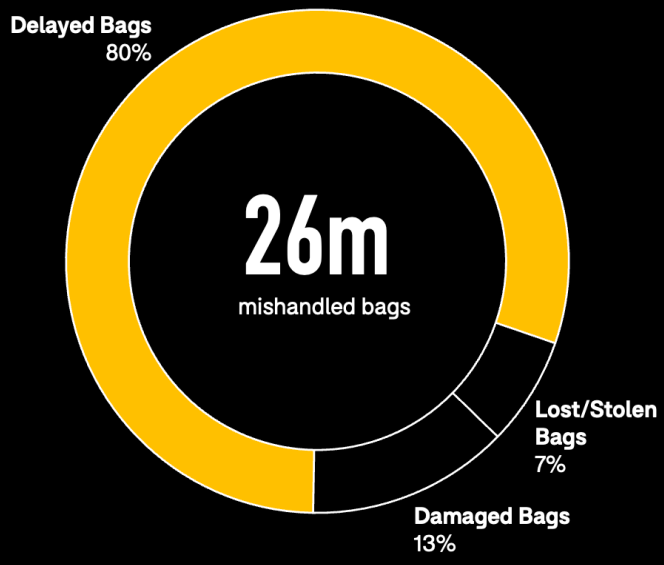
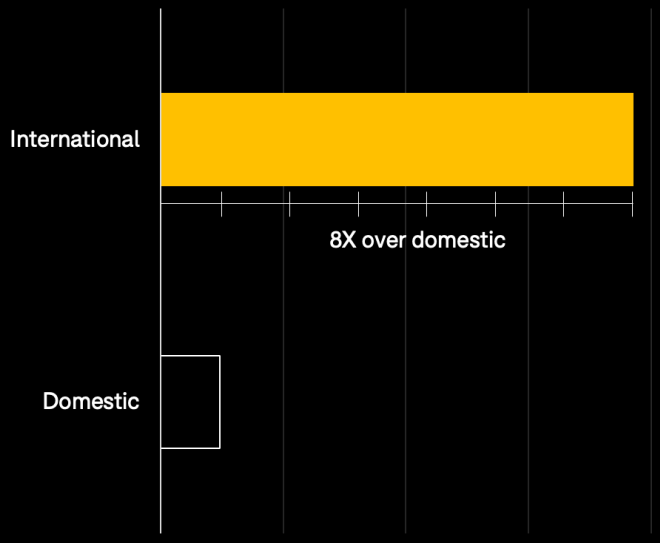
Breakdown

The state of baggage mishandling today

Share of mishandled bags by eventual outcome in 2022



Share of mishandled bags by flight type in 2022



Source: SITA

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particularly in international travel. SITA's data indicates that:

- Transfer bags constituted the majority of mishandled bags in 2022.
- The rate of mishandled bags on international flights was found to be eight times higher compared to domestic flights.

This is the case, as mishandling during transfer is one of the primary reasons why luggage may be delayed or lost, and often occurs when handling systems do not have enough time to transfer bags between flights. So, the likelihood of mishandling increases the more baggage is transferred - making trips with multiple stops especially vulnerable to luggage complications.

Besides causing immense frustration for passengers, the problem of mishandled baggage also represents a significant financial burden for the industry. Airport Industry News highlighted that mishandled baggage, particularly the over 4 million bags mishandled during transfers, cost the industry an alarming $2.2 billion USD in 2022 alone.

What factors are contributing to this alarming uptick in mishandled baggage rates?

The next section delves into the underlying causes of this rising trend.

THE ROOT CAUSE BEHIND MISHANDLED BAGGAGE

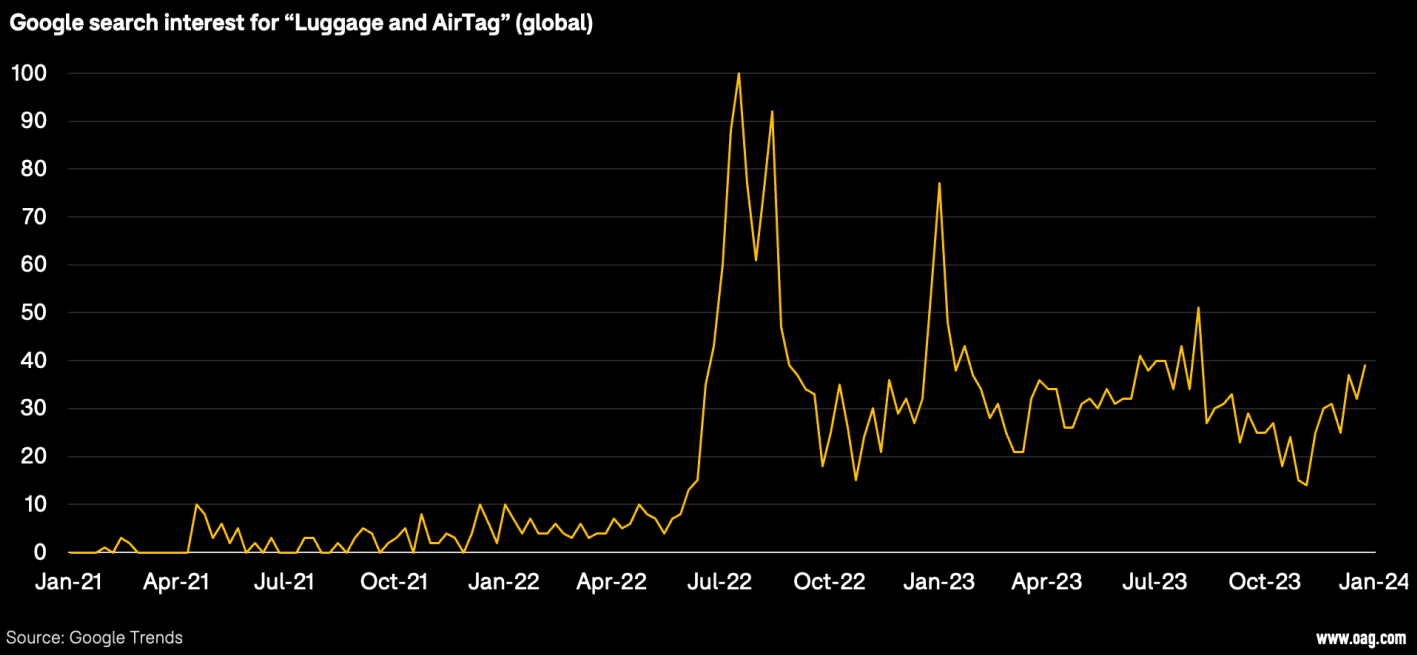
The increase in mishandled baggage rates since 2020 can primarily be attributed to the labor shortage at airports. During the pandemic, the travel industry faced a significant downturn, leading to the dismissal of thousands of employees. However, as travel resumed, the industry struggled to rehire staff, resulting in a manpower deficit, particularly in ground operation roles like baggage management. A 2023 IATA survey found that 60% of ground handling supervisors felt they didn't have enough qualified staff to ensure smooth operations.

This scarcity has led to a reduction in the number of bags delivered directly from one aircraft to another (tail-to-tail transfers), resulting in an increased number of bags failing to connect to their intended flights. Moreover, the resurgence of international travel and persistent congestion at airports compound the challenge.

As Aviation Pros have pointed out, a significant issue in baggage management is the absence of comprehensive, real-time data sharing among airlines, airports, and ground handling teams. This gap in interconnected data flow and real-time tracking capabilities often results in misplaced luggage and delays. In this context, OAG plays a crucial role by enabling data connectivity. By simplifying complex data and integrating seamlessly into various systems, OAG provides a consistent and reliable source of information that helps streamline baggage management across different stakeholders.

Trend

Travelers are turning to personal consumer tech to track their luggage



Source: Google Trends

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PRIORITIZING BAGGAGE MANAGEMENT THROUGH TECH

In response to increasing mishandled baggage rates, there has been a concerted effort from both travelers and airlines to enhance baggage management through innovative technology solutions.

Travelers, faced with a lack of clarity and real-time information regarding their luggage, have increasingly turned to personal tracking devices like Apple's AirTags. These gadgets offer a sense of control and reassurance by enabling passengers to track their luggage.

The growing interest in self-tracking solutions is evident in online search trends. For example, online searches for "luggage tracking" have seen a dramatic increase of 220% over the past year, while Google searches related to luggage and "Airtag" have more than quadrupled since early 2022 (see chart above).

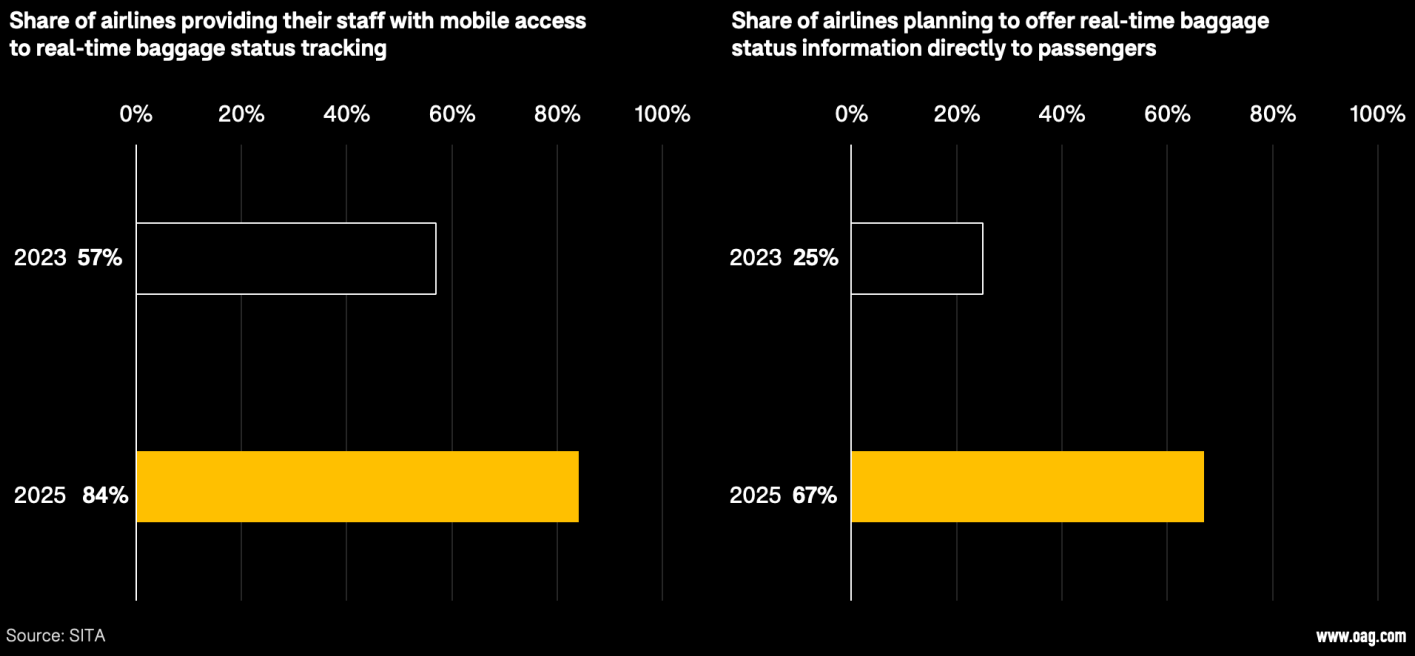
On the airport and airline front, there's a clear recognition of the need for improved technology in baggage management as well. According to the Airport Business 2023 Baggage Handling System survey, 75% of North American airports plan to upgrade their baggage handling systems within the next five years.

According to SITA research, real-time baggage status updates are also becoming a top priority for airlines:

- Currently, 57% of airlines have equipped their staff with mobile access to real-time baggage information, a figure that's expected to rise to 84% by 2025.
- Additionally, a significant 67% of airlines plan to extend this capability to passengers, a considerable jump from the current 25%.

Outlook

Real-time baggage status information has become a key priority for airlines



Source: SITA

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The latter shift towards providing passengers with baggage status information is particularly crucial. To deliver an optimal passenger experience, it's essential that airlines not only streamline their internal processes but also share relevant information with travelers.

Creating a user-friendly baggage tracking dashboard for passengers would bridge the gap between airlines and their customers, enhancing transparency and satisfaction. So the key to fully optimizing the baggage journey lies not only in the seamless flow of real-time data among airports, airlines, and ground handlers but also in empowering passengers with access to this information.

THE RISING TIDE OF BAGGAGE MANAGEMENT TECH

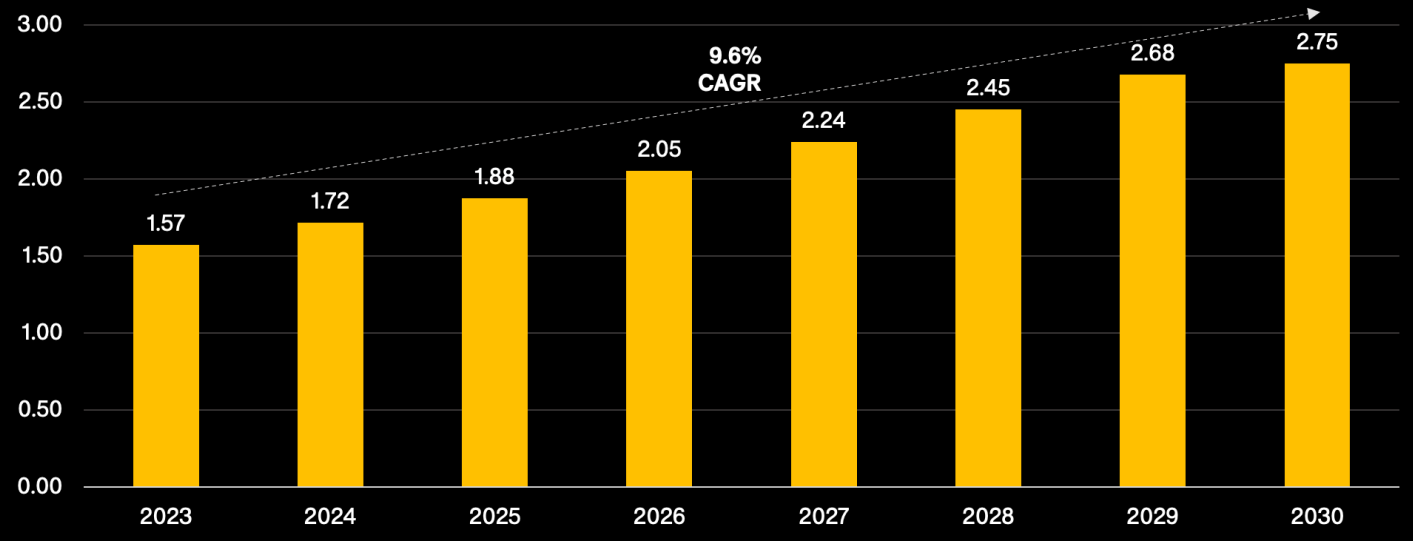
Fortunately, the recent surge in mishandled baggage rates has catalyzed a wave of innovation in baggage management technology, promising transformative solutions for both industry operators and travelers.

The global airport baggage handling software market, for example, is witnessing remarkable growth. Projections indicate that the market size, valued at $1.57 billion USD in 2023, is set to expand to an impressive $2.75 billion USD by 2030. This represents a robust compound annual growth rate (CAGR) of nearly 10%, underscoring the

Outlook

Software is expected to further transform today's baggage management systems

Projections of the global airport baggage handling software market (in billion USD)



Source: Fortune Business Insights

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sector's dynamic and upward trajectory. This forecast, supported by studies from firms like Mordor Intelligence, reflects the sector's vigorous expansion and potential.

The core appeal of these advanced baggage handling systems lies in their comprehensive approach to enhancing every step of the baggage journey. They proactively address issues like misplacement or loss, by integrating passenger and baggage data and identifying potential problems before they escalate. This preemptive strategy is vital for managing high-priority flights and passenger connections efficiently.

Key to this process is the software's ability to seamlessly integrate with various airline systems, from flight information to booking and departure control. This integration ensures real-time updates are shared across all relevant teams, from dispatchers to ground handlers.

Advanced software systems also aim to balance tail-to-tail transfers, considering resource availability and workload. Baggage managers can define specific time windows for cut-off times, within which the software dynamically maximizes tail-to-tail connections. This innovative functionality is currently undergoing trials with leading airlines, showcasing its potential to streamline operations.

Parallel to the importance of software systems in managing baggage flows, Radio-Frequency Identification (RFID) technology has arguably played the most significant role in the context of airport baggage handling innovation in the past few years. RFID offers several advantages over traditional barcode scanning methods. It allows for the automatic tracking of luggage throughout the baggage handling process without the need for direct line-of-sight scanning. This not only enhances the efficiency of baggage tracking but also

significantly reduces the chances of baggage mishandling. Delta Airlines, for example, handling way over 100 million bags annually, was one of the first carriers to **adopt RFID technology** for baggage handling. Since 2016, the carrier has expanded its RFID tracking to all of its 344 global stations. This technological advantage may be one of the reasons why Delta has consistently scored better mishandling rates compared to its main legacy competitors, American and United. By the end of 2023, Delta not only ranked as the second-best U.S. airline for baggage handling but also achieved an impressive baggage mishandling rate **of just 0.34%**.

However, RFID turns out not to be the all-encompassing solution for tracking baggage, facing a range of challenges. High implementation costs, a lack of standardized interoperability between different airports and airlines, and limited coverage in some areas hinder its effectiveness.

Given that the perfect tech solution is not yet in place, airports and airlines are actively engaging in internal innovation programs themselves, experimenting with the latest baggage management solutions. These initiatives are not mere trials but concerted efforts to revolutionize how baggage is handled, tracked, and managed, significantly reducing the number of incidences of mishandling and delays.

Let us explore some of the most promising companies and use cases advancing next-gen innovative baggage management solutions. They offer a glimpse into the future of baggage handling in the aviation industry.

Here's an overview of some notable projects:

Full automation at Changi Airport: Changi Airport showcases a notable advancement in baggage handling with its fully automated Terminal 2 Early Baggage Storage (EBS) system. Spanning 5,120 square meters, this system features automated cranes that manage luggage storage and retrieval across a 13 km subterranean network, connecting three terminals. The shift to full automation has significantly streamlined operations, allowing the airport to free up to eight workers per shift to do more productive work, thus setting a new standard in efficient and automated baggage management.

High-tech baggage handling at Denver International Airport: In December 2022, Denver International Airport upgraded its baggage handling capabilities with the introduction of the Checked Baggage Inspection System (CBIS) by TSA. This sophisticated system, which costs around USD $160 million, utilizes an extensive network of conveyor belts to efficiently sort and track luggage through the security screening process. Separately, Southwest Airlines and Leonardo have embarked on a project to reshape the transfer bags terminal via next-generation cross-belt sorter technology.

Automatic "reflight" bag management at Munich Airport: Lufthansa Group, in collaboration with SITA, has introduced a new baggage management solution at Munich Airport: SITA's WorldTracer Auto Reflight. This system streamlines the handling of "rush bags" – luggage that doesn't initially accompany the passenger on their flight. Utilizing the original bag tag information, WorldTracer Auto Reflight automatically suggests the most suitable alternative flight routing for these bags, with SITA estimating that the widespread adoption of such automated reflighting could potentially save the global aviation industry up to USD $30 million annually in costs related to mishandled baggage.

Stansted Airport's £70m upgrade: The UK's Stansted Airport completed a major overhaul of its baggage system post-pandemic, installing 2.4km of new track – the world's longest system of this kind. The upgrade includes 180 automated carts and accelerates baggage handling to impressive speeds, ensuring bags are ready for loading in just six minutes.

Self-driving luggage vehicles at CVG: North Kentucky International Airport (CVG) has been experimenting with self-driving vehicles for luggage transportation between terminals and aircraft. The project, initiated in 2020 with technology from ThorDrive, involves converting a standard ground tug into an autonomous vehicle, showcasing an innovative approach to airside operations.

These projects represent only a few examples of technology-driven solutions in baggage management going beyond RFID, providing a glimpse into the aviation industry's commitment to innovation and enhanced operational efficiency.

STARTUPS REVOLUTIONIZING BAGGAGE MANAGEMENT

The baggage management sector is also experiencing a surge of innovation, spearheaded by tech companies and startups. Their solutions range from real-time tracking via Bluetooth to advanced biometrics.

Here's a glimpse into some of these pioneering companies:

INFORM's GS baggage software planning: This long-standing aviation company is a global leader in offering intelligent optimization solutions tailored for airlines, airports, and ground handlers. Its platform, GS RealTime, focuses on optimizing the deployment of staff and equipment, ensuring maximum efficiency in baggage handling processes.

Brock Solutions: The company is a key player in optimizing existing baggage handling systems (BHS) for airports and airlines. Brock Solutions provides solutions for modernizing and automating baggage, enhancing efficiency across various airport sizes.

Bob.io's TravelTag: The unique Bluetooth tracker by 2017-founded Bob.io offers a dual advantage. It provides airlines and passengers with live updates on baggage and ground-handling equipment, ensuring transparency and efficiency in baggage management.

AirPortr: The solution by AirPortr integrates with airlines to provide a seamless luggage check-in and delivery experience. Travelers can have their bags collected from their homes, offices, or hotels at a scheduled time, with AirPortr ensuring the bags are checked in at the airport. This service not only adds convenience for travelers but also helps airports optimize baggage handling infrastructure and reduce congestion.

BagsID: Operating as a mobile recognition app, London-based BagsID is set to revolutionize baggage handling with its biometric approach. By identifying bags based on unique physical characteristics, like scratches or dents, BagsID negates the need for barcodes or RFID tags. This technology, tested at Aeroporti di Roma, promises to enhance efficiency and accuracy in baggage tracking.

Orok: OROK is at the forefront of automating baggage and cargo handling on the airside. Its solution includes a fleet of Autonomous Guided Vehicles (AGV), supervised by a server that performs data analytics and incorporates AI. This approach is intended to significantly improve the logistics flow within the airport environment.

THE FUTURE OF BAGGAGE MANAGEMENT

As the aviation industry continues to evolve, the role of data and technology in enhancing baggage management is becoming increasingly pivotal. The innovations we've highlighted in this article represent a significant shift towards smarter, more efficient, and customer-focused baggage handling systems.

The challenge often lies in overcoming legacy systems, which can be restrictive due to their antiquated nature. The future lies in cloud-based solutions capable of integrating and analyzing relevant data across the entire baggage journey. This approach not only improves tracking and reflighting, but also represents a broader industry trend: reimagining data infrastructure to support innovative technologies and emerging practices.

Embracing this evolution involves not just the adoption of more advanced conveyor belts and RFID but also a commitment to the sharing and democratization of airline data. This shift toward open and interconnected data systems stands to benefit the entire aviation ecosystem. It paves the way for more collaborative efforts, fostering industry-wide improvements in efficiency, sustainability, and passenger experience.

In this transformative journey, our focus at OAG is on enabling this evolution by providing accurate, real-time data that supports the industry in embracing the potential of next-generation baggage management solutions. We're committed to contributing to a future where data-driven practices underpin the continuous improvement and innovation within the airline industry.

FINAL WORDS

As we reach the conclusion of this report, we reflect on the data-driven journey through the critical operational aspects of airline management: The Aircraft Turnaround, Flight Planning, and Baggage Management. This exploration has highlighted the significant role of technology and innovation in transforming these vital areas of airline operations.

While we have delved deep into these specific sectors, it's important to recognize that they are part of a much broader, continually evolving landscape. The full scope of technology's transformative impact on the airline industry encompasses a much wider range of operational and commercial facets, many of which are still unfolding. So our report journey through some of these specific topics sheds light on just a fraction of the potential that technological advancements hold for the airline sector.

This report, therefore, is not an endpoint but part of an ongoing dialogue. It represents a step forward in our collective understanding of how innovation and digital transformation are reshaping airline operations. The insights and analyses presented here are meant to provide a foundation, one that we will continue to build upon as we navigate through the complexities and embrace the opportunities of this dynamic industry.

We at OAG are committed to continually uncovering and examining the changes, challenges, and opportunities that lie ahead. Therefore, we invite you to join us on this journey and regularly visit the OAG website for further insights into the future of travel. Together, we will continue to navigate this rapidly evolving industry, always on the hunt for the next transformative trend.

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