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2023 Turnaround Benchmark Report

Room for improvement

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CEO intro

This is the aviation industry's first Turnaround Benchmark Report, highlighting how turnaround operations impact the overall performance of airlines and airports.

The industry operates on slim margins. Increases in fuel prices can tip an airline from profit to loss, as can finance costs. Big data analytics is changing the way airlines manage those slim margins, with extensive work creating a complete data picture of airline operations to improve on-time performance. However, the biggest gap remains in the turnaround process.

Until recently, it has been an invisible part of airport operations. The resulting inefficiencies increase the time needed for turnaround operations. In extreme circumstances, this means canceled flights. This is an issue for airlines, airports and ground handlers, costing billions of dollars each year.

At the same time, passengers expect a smooth experience, which includes arriving at their destination on time. They are prepared to accept that their seat might be a bit cramped but in return they do not expect to have to wait. In fact, delays are consistently in the top three on the list of complaints about airlines.

Frost & Sullivan has found that even a **1% decrease** in on-time performance can lead to a **0.6% decrease** in an airline's Net Promoter Score.

That inevitably has an impact on the passenger experience and therefore the bottom line.

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Another dimension is environmental sustainability, which must be everyone's urgent concern.

The combination of the need to constantly find cost savings and time savings, to improve the passenger experience and to reduce emissions, means the industry as a whole spends a lot of resources analyzing every aspect of its operations to find those savings where it possibly can.

However, until recently, that analysis did not include the turnaround. It is difficult to see the full picture because it involves different entities performing a variety of complex tasks, providing plenty of opportunities to allow delays to creep in. The flip side is that there is also the opportunity to make time savings.

It is very clear there are many reasons for flight delays, including weather, air traffic control issues, and even staff being late for work. But many delays at the turnaround are predictable and, therefore, entirely avoidable.

The starting point is understanding exactly what happens at the turnaround. And that is what this first Turnaround Benchmark Report does. It highlights where the delays occur and their time, money and environmental cost. In doing so, it shows where improvements can be made. After all, you can only manage what you can measure.

There are significant gaps between the **best** and **worst** turnarounds, showing just how much more can be done to make the turnaround more efficient in every way.

It is particularly striking that all but the best turnarounds introduce some delay.

Each gate at each airport is different, and many airlines' operating models are different too, so unfortunately there is no universal solution to making the necessary changes. But by providing visibility of the issues for the first time, our aim is to give airports, airlines and ground handlers the tools to start the process of making marginal gains.

I hope you find this report useful.

Max Diez, CEO, Assaia

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Executive Summary

- The key finding is the average ground delay, the time lost during turnaround operations, varies between 8 minutes for the best performers to 26 minutes for the worst
- There is a 41-minute difference between the best and worst average turn time; the best performers can deliver three more turnarounds per day than the worst ones
- Many turnarounds introduce some delay, even if there are other sources of delays including air traffic issues and weather. Those delays add up and can cause canceled flights at the end of the day
- Tasks in turnarounds are interdependent. Efficiencies prevent knock-on effects, ensuring on-time boarding and punctual departure. The opposite is rushed execution, delays, increased costs, and negative passenger experiences. Safety issues and delays for subsequent flights also occur
- The major causes are delays to actions around catering, refueling, unloading and loading, and preparing for pushback. During the worst turnarounds, the actions start late and are typically rushed and uncoordinated
- There is a dollar and environmental cost to some activity, in particular prolonged APU usage costs the equivalent to the profit made from 11 passengers and produces nearly 86kg of CO_2 emissions
- Systematic monitoring of the turnaround is a relatively new concept
- This report uses monitoring data from 150,000 turnaround operations at multiple airports and covering over 25 airlines, provides patterns showing the industry's turnaround performance, including areas for improvement
- Improving turnaround performance requires careful monitoring, leading to increased efficiencies and enhanced decision-making

The best performers can deliver three more turnarounds per day than the worst ones:

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Difference between the best and worst average turn time potentially costs airlines and airports billions of dollars a year:

41 min difference

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Avoidable APU usage costs the same as the profit from 11 passengers and produces 86kg of CO_2 per flight:

profit from 11 passengers

=

86kg

CO_2

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Methodology

Assaia works with airports and airlines around the world, using a combination of Artificial Intelligence and computer vision to build a complete picture of turnaround operations to adjust processes, and to provide constant automated monitoring to facilitate second-by-second decision-making.

The turnaround is defined as when the aircraft parks at the gate until pushback for departure.

The key objective of this Report is to highlight the sources of the delays during the turnaround, and the differences between the best and worst performers. This information provides airlines, airports and ground handlers with the data they need to better understand how they can reduce turnaround delays, increase on-time performance and, ultimately, improve the passenger experience.

The data in this report is drawn from our extensive operations over the 12 months from June 2022 to June 2023. Assaia is the biggest supplier of AI-enabled turnaround monitoring technology, making this the most comprehensive report of its kind available today.

> “Assaia’s Turnaround Benchmark Report dives into industry benchmarks, showcasing how different events collaborate to optimize the entire process. The visibility it offers sheds light on the best and worst-case scenarios and helps us plan effectively as we fine-tune our processes.
>
> **Zeljko Cakic**, Director, IT, Airport Development Program, Greater Toronto Airports Authority

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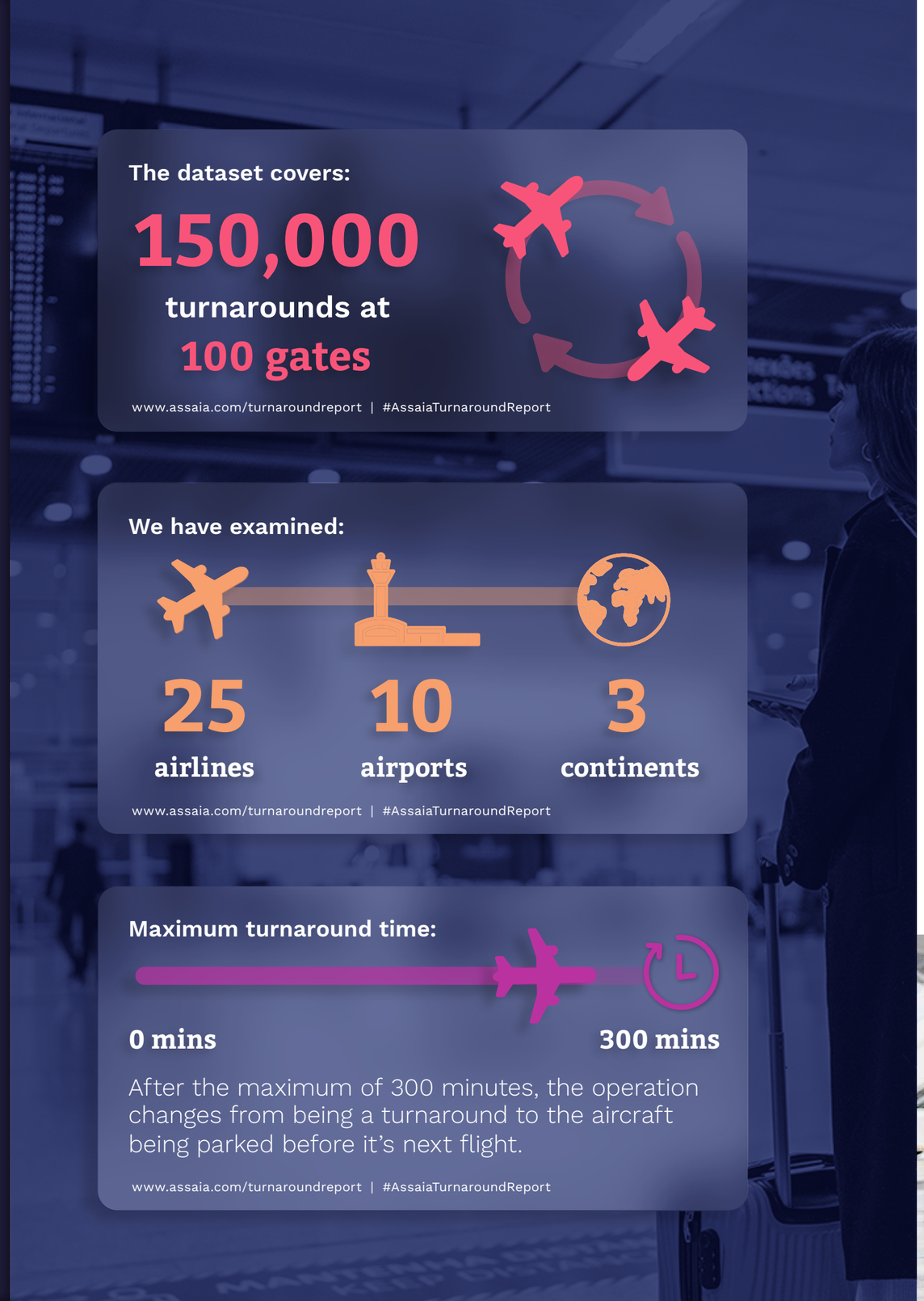

The numbers all refer to short-haul flights. This is because the turnaround is particularly important for short-haul, where delays throughout can lead to flight cancellations at the end of the day. And on short flights, the turnaround is often the only variable that can be used to make up time.

We have used global figures in the Report, without breaking them down regionally. This is because the geographical spread of the current data does not allow us to draw meaningful conclusions. However, we expect to be able to add regional variation in the 2024 Turnaround Benchmark Report.

For each metric, we have examined the 25th, 50th and 75th percentiles. These values represent the median performance of the worst-performing third, the middle performing third and the best-performing third. The numbers themselves are interesting. However, what is perhaps more interesting is the difference between the best and the worst, and resulting cost in terms of time and money, and the environmental cost.

This is the industry's first annual Turnaround Benchmark Report. The same methodology will be deployed to analyze the data from June 2023 to June 2024 and thereafter. We will be able to track the changes in the industry's turnaround performance over time, as well as continuing to highlight areas for improvement.

The total dataset is nearly 150,000 turnarounds at around 100 gates. It covers over 25 airlines at 10 airports on three continents, and 101 different aircraft types. We have examined only turnarounds that are a maximum of 300 minutes (five hours), because that is when the operation changes from being a turnaround to the aircraft being parked before its next flight.

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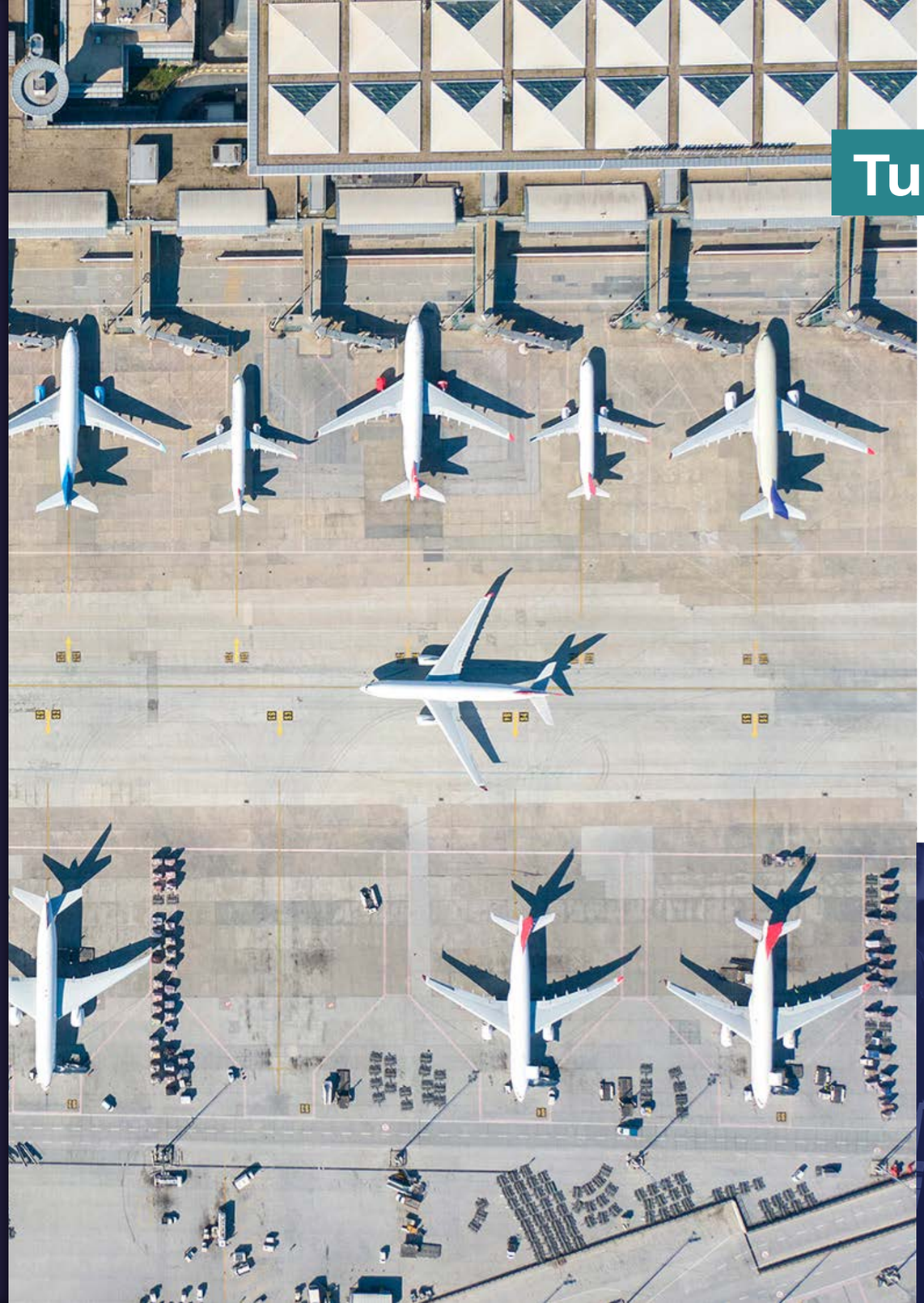

Turnaround variables

The turnaround has, until recently, been an invisible part of airport operations. It has not been monitored systematically and as a whole, resulting in inefficiencies which negatively affect on-time performance. This is an issue for airlines, airports and ground handlers, costing billions of dollars each year.

Ultimately, it is an issue for passengers. They are the ones who are delayed.

A single turnaround typically consists of hundreds of individual tasks, involving more than 75 different people. The major items are unloading and loading passengers, baggage and cargo.

Catering supplies also need to be unloaded and loaded. Ground power and pre-conditioned air need to be attached and stopped. The aircraft needs to be fueled and cleaned. And the crew might need to be changed.

Each of these elements is itself a complex operation, requiring different people and careful timings. Each is coordinated by the airport, airline or ground handler, with a clear reporting chain. That makes them efficient in their own right.

> “As passenger numbers are expected to continue to increase, airports must maximize the use of their available capacity to meet future demand. Assaia’s Turnaround Benchmark Report demonstrates the impact of efficient operations on the ramp, in the right conditions enabling up to 3 more turns per day. A definite win for both airports and airlines!
>
> **Thomas Romig**, VP Safety, Security, and Operations ACI World

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Turnaround variables

En route | Touchdown | Taxi-in | Turnaround | Fueling | Pushback | Turnaround ends | Taxi-out | Takeoff | En route

Touchdown

Takeoff

- **Cargo unloading**
  - Baggage unloading
- **Cargo loading**
  - Baggage loading
- **Aircraft maintenance**
  - Management functions (coordination, admin, representation)
- **Catering**
  - Fueling
  - De-icing
- **Parking**
  - Ramp condition
  - Cleaning (interior/exterior)
- **General passenger**
  - Cabin services (water, toilet, equipment)

Safety and sustainability measures

However, historically there has been minimal overview of the entire turnaround. This is largely because so many people, from different organizations, are involved in all the operations required. Each operation is carefully managed because there is often no complete and detailed visibility of the entire process, and the current manual check are subject to human error.

The result is insufficient data to make the proper decisions, which include timely staff allocation and ensuring the right resources are available at the right time and in the right place. Piecing together that information, and acting on it effectively, reduces the turnaround time. That benefits the passengers and the airline by improving on-time performance.

It also benefits the airport by making more efficient use of the gate, with the potential of increasing the number of turns per gate in a day. And it is far cheaper to make more efficient use of the available resources than to build new ones, though many airports do not have sufficient real estate to build more gates.

Complete visibility of the turnaround also reduces safety incidents, by making any unsafe behavior visible, triggering relevant alerts and allowing for better training of employees.

> “The Turnaround Benchmark Report by Assaia underscores the dynamic interplay of apron events and the shared responsibility of all stakeholders - from ground handlers to airlines and airports - in optimizing passenger outcomes and ensuring they reach their destinations on time.
>
> **Eric Takechi**, General Manager of Aviation, Space & Defense Dept. Marubeni Corporation

Finally, making the turnaround more efficient helps reduce fuel usage, cutting both costs and emissions, in two key ways. First, monitoring the use of the Auxiliary Power Unit (APU) means more rigorous enforcement of policies restricting APU usage at the gate. Second, more accurate off-block predictions reduce taxi times for both incoming and outgoing aircraft.

In this Report, we quantify those benefits and highlight the opportunities of realizing them. This is important because every other element of the journey is measured extensively, from passengers searching for their flights at the very beginning of the process, through check-in, baggage handling, the airport experience, the flight itself and the passenger leaving the arrival airport. Until now, a holistic view of the turnaround has been the missing part of the complex jigsaw.

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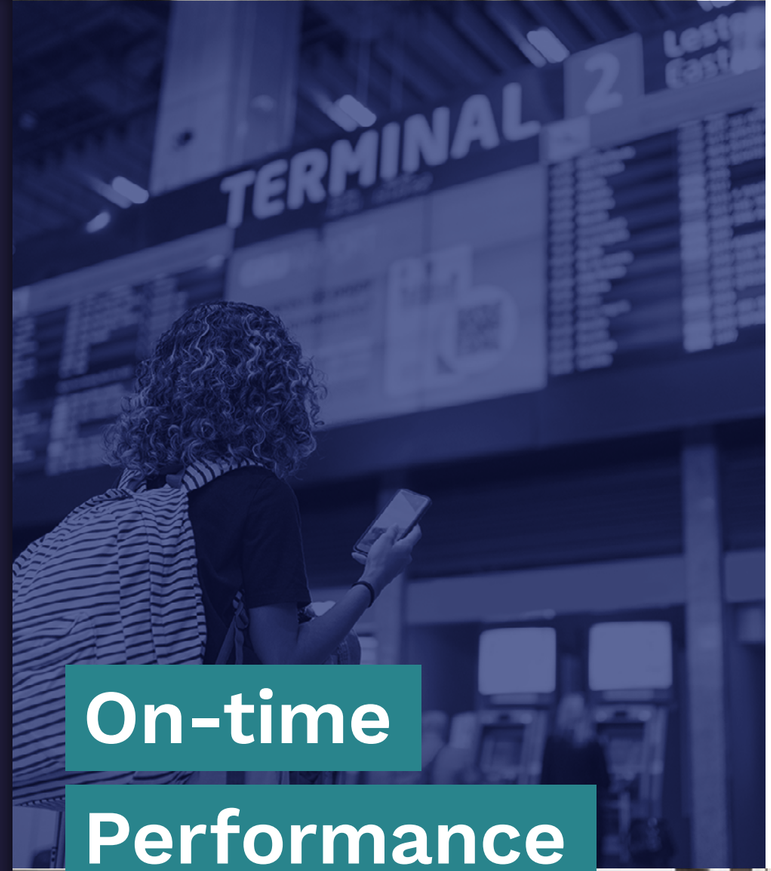

On-time Performance

On average, flight departures are delayed.

To be clear, that does not mean every flight departs late. However, the average turnaround introduces some delay and the worst ones can cause the loss of a segment at the end of the day's operations.

How many times have you heard that your flight is delayed because of the late arrival of the plane? That is how delays accumulate and, in the worst case scenario, the last flight of the day has to be canceled. The passengers then have to spend the night in a hotel and find a flight for the morning. It's a lose-lose: passengers are unhappy and the airline incurs extra costs.

This is avoidable. But it is important to quantify the issue before finding ways to fix it.

What is perhaps most striking is that the **best performers** deliver three more turnarounds per day than the **worst ones**.

It is important to remember these are averages: some airports and airlines manage eight turnarounds in a day. Those three extra flights a day translate into a lot of revenue for airlines and airports alike. And it is expensive to have aircraft sitting still and gates not operating at their full capacity.

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On-time performance

The groups' average turnaround times range from 107 minutes to 66 minutes. Again, these are group averages, so do not include the extremes of the best and worst performances.

The most important number is the average ground delay. This is the time lost during turnaround operations. It is also, therefore, where time can be made up by making turnarounds more efficient.

The average ground delays vary between eight minutes for the best performers to 26 minutes for the worst.

Eighteen minutes might not seem very long, but it comes to an hour and a half over five segments during a day. That can be **the difference between the last flight going or not**. There is also a direct cost to any delay: according to Airlines 4 America, the association of US airlines, delays **cost airlines just over $100 per minute**.

On the basis that you cannot manage what you do not measure, it is essential to understand what goes into creating that delay. That is the only way to make the required changes to the processes. It also leads to protocol changes, implementing more effective alerts to feed into decision-making when something does not go according to plan, for which constant automated monitoring of the turnaround is necessary.

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> “As a strategic venture capital firm, we aim to assist JetBlue in boosting efficiency and enhancing its operations. Assaia’s Turnaround Benchmark Report offers invaluable insights into the various aspects of aircraft turnaround, such as baggage handling, catering, water, and fuel refills. Identifying and addressing issues in these areas is crucial for avoiding costly delays and ensuring customer satisfaction.
>
> **Jim Lockheed**, Investment Principal, JetBlue Ventures

Efficiency

Turnarounds involve numerous tasks, with the exact count varying based on different definitions.

It’s important to note that many tasks within turnarounds have interdependencies. Starting and finishing early eliminates knock-on effects within the turnaround, ensuring on-time boarding and increasing the likelihood of punctual departure. Conversely, late starts result in rushed execution or delays, leading to increased costs for airlines, capacity loss for airports, negative passenger experiences, safety issues and potential delays for subsequent flights waiting on the taxiway. Moreover, many tasks lack slack due to existing efficiency pressures, making it challenging to make up lost time if delays occur.

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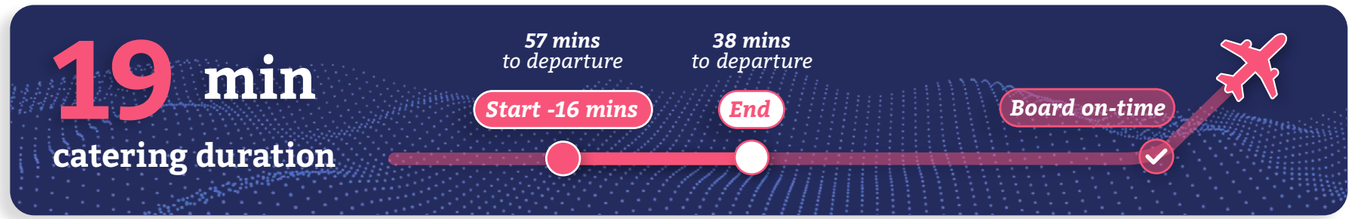
Catering

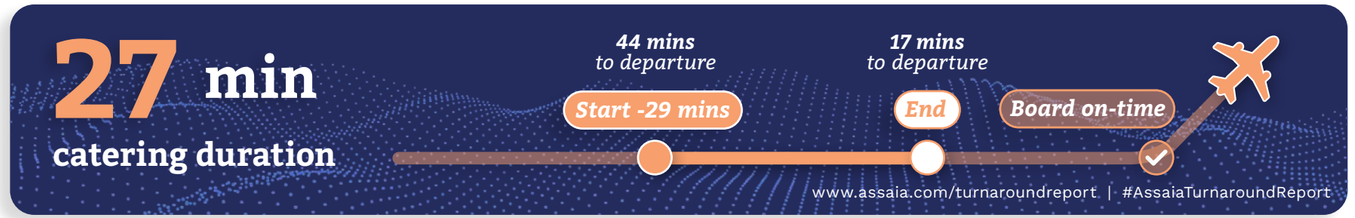
During the **best turnarounds, tasks related to catering start 73 minutes before departure**, a full **29 minutes before the worst performance. The worst performers also take 12 minutes longer to complete the process**, demonstrating their inefficiency. And because they start later than the best performers, they also finish later, much closer to the scheduled departure time. This leaves less room for error, introducing the potential of delays or reduced service for passengers.

Best performance catering:

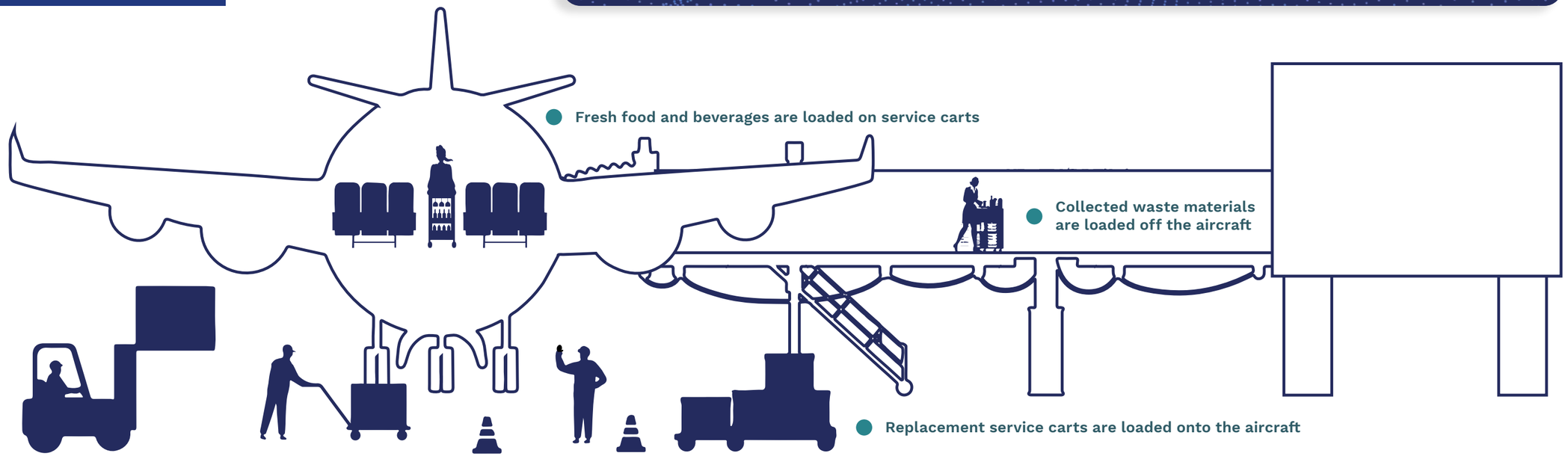
Middle performance catering:



Worst performance catering:



Catering process



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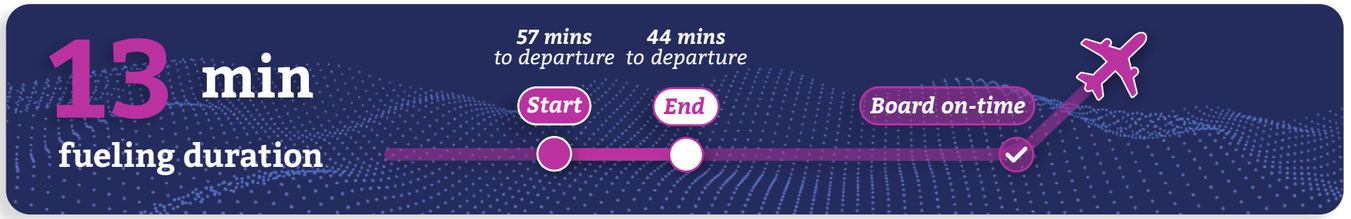
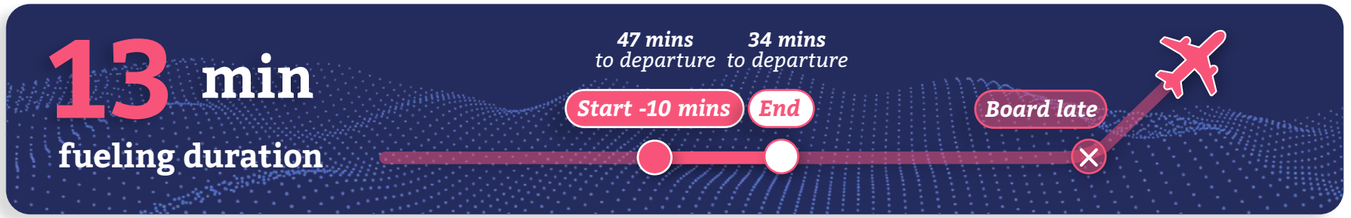
Fueling

The same pattern applies to fueling. Again, the **best turnarounds start fueling 20 minutes earlier** than the **worst performers**. The duration of the activity is determined by the amount of fuel that needs to be loaded, meaning there is no way of making up time, leaving no room for any errors or changes. Safety is obviously central to fueling and, if a late start adds time pressures, this can lead to the temptation to cut corners. For most airlines, in most airports, fueling needs to be completed before passengers board the aircraft. Later fueling starts mean, therefore, later boarding starts.

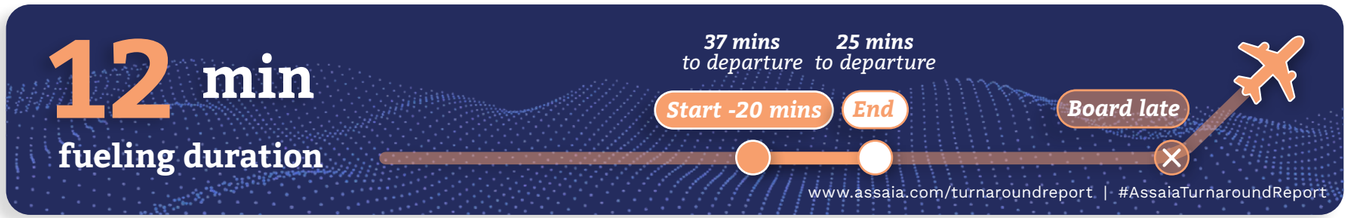
Best performance fueling:



Middle performance fueling:

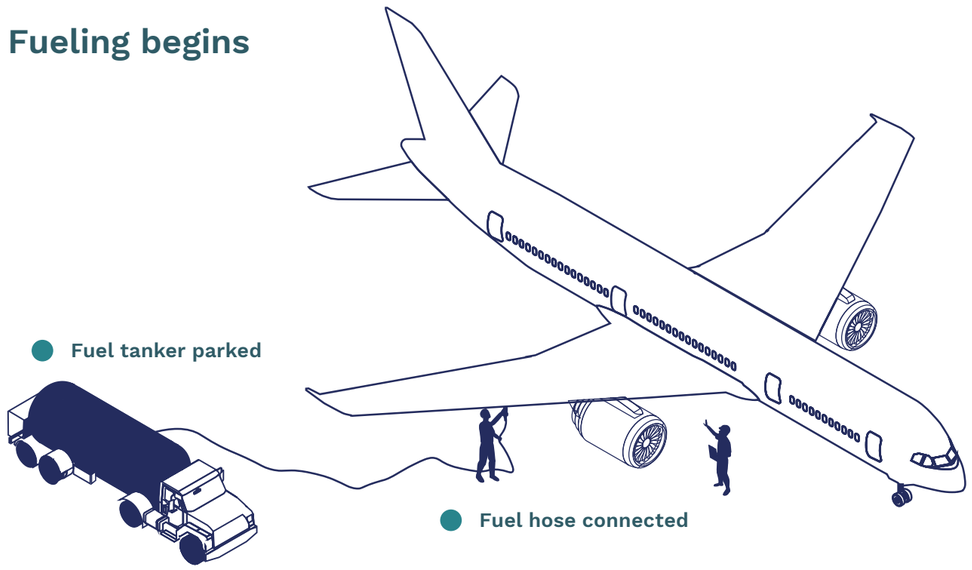


Worst performance fueling:

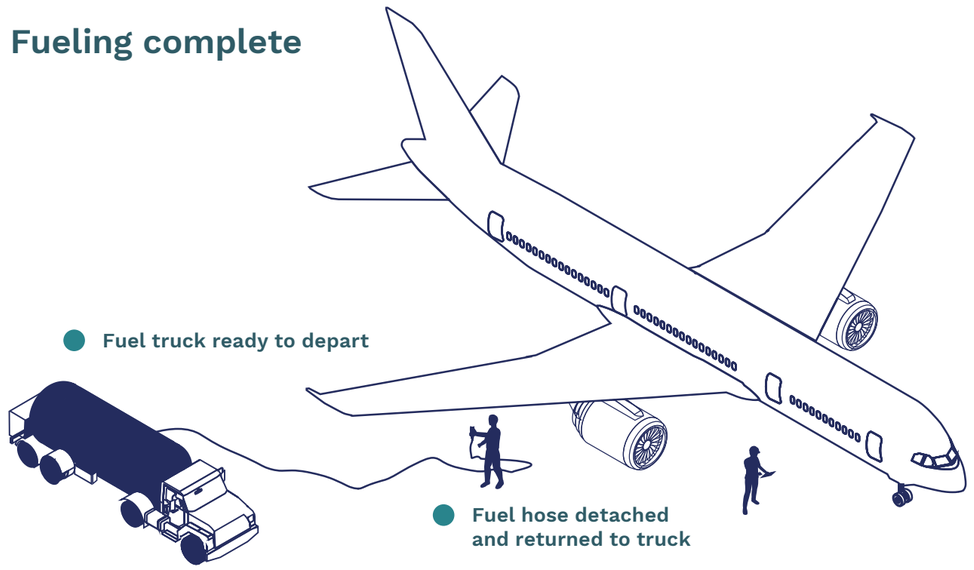


Fueling process

Fueling begins



Fueling complete



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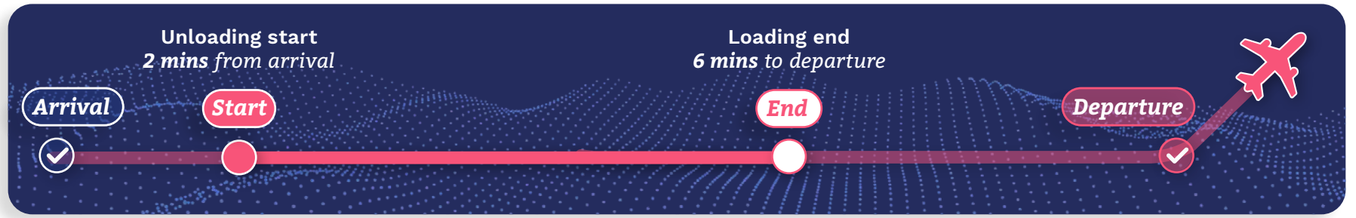
Unloading and loading

Unloading has been examined in a different way. Rather than measuring its start against the scheduled departure, it is measured against actual arrival time. **This is an important distinction because it shows how well prepared the team is**, which in turn is based on the quality of the information available about arrival times. More exact real-time data allows an earlier start. The difference is very small at just one minute. However, that minute is indicative of the efficiency of the process. It also pays dividends in the finish time. Importantly, it also means passengers get their baggage quicker, improving the passenger experience.

As with catering and fueling, the best performers finish loading on good time before departure. The nine minute difference between the best and worst performers again introduces rush into the end of the turnaround process.

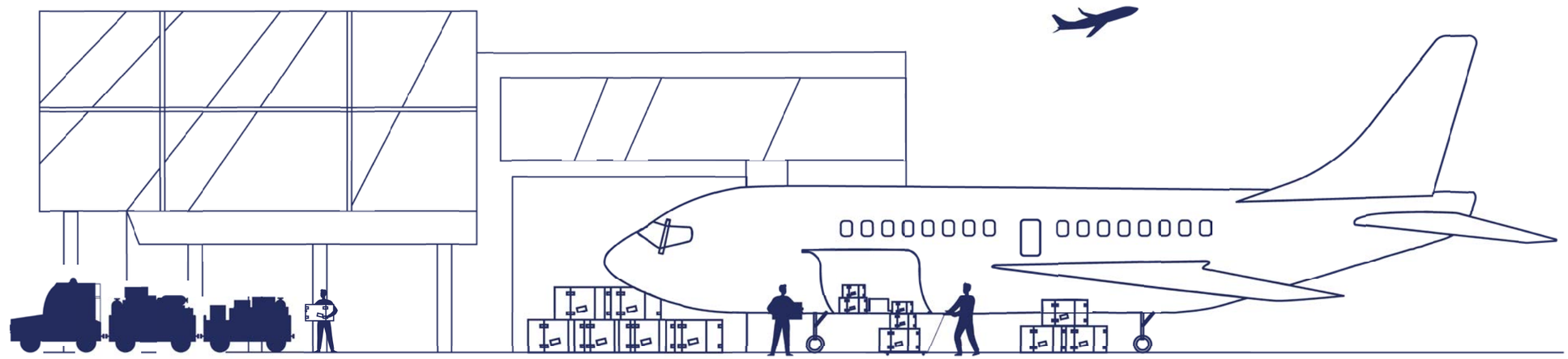
Best performance unloading/loading cycle:

Middle performance unloading/loading cycle:



Worst performance unloading/loading cycle:

Unloading process



- Loaded towing tractor drives baggage carts to airport
- Baggage is placed on conveyor carts for transportation to the terminal
- Baggage handlers locate and remove checked baggage from cargo compartments

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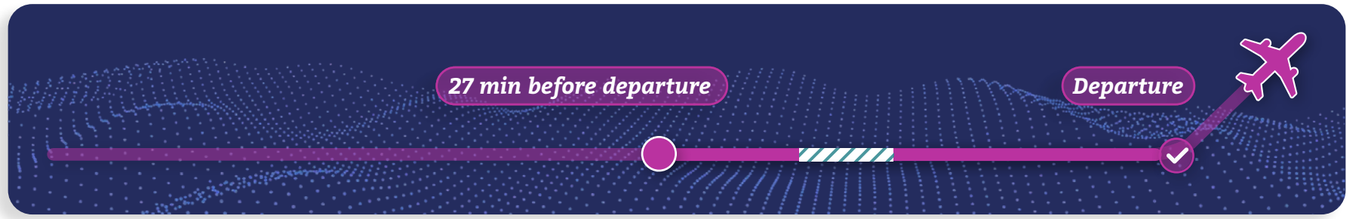
Pushback connect

A critical task for on-time departure is connecting the pushback tug on time. Connecting the pushback too late can cause a delay. That is obvious. However, connecting it too early means this expensive resource will be idling for a long time.

The data shows very large differences in the time when pushback is connected. In part, this is because of different operating models. However, even if you have a pushback tug for each stand and always connect early, it does not necessarily mean it is the most efficient protocol.

The analysis shows that connecting the pushback 20-15 minutes before departure is the ideal balance between resource efficiency and having some buffer. The best performing group connects on average 27 minutes before departure. The middle group on average connects seven minutes before departure, which is perhaps too tight. However, the worst performing group connects the pushback 55 minutes before departure. That length of buffer is entirely unnecessary and is a very inefficient use of resources.

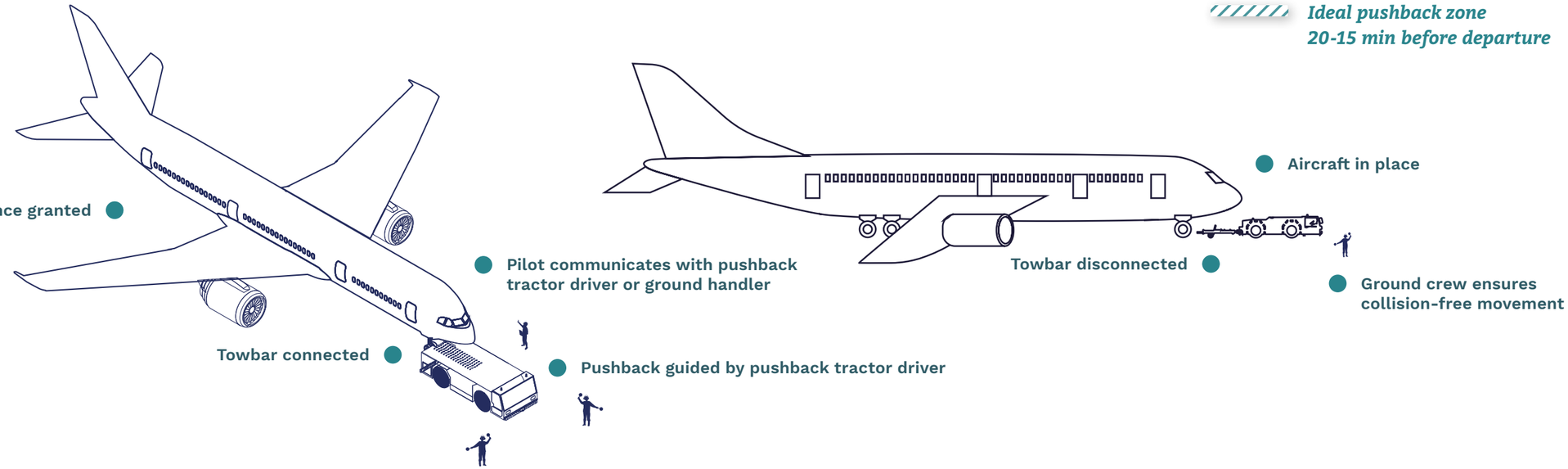
Best performance pushback connect:



Middle performance pushback connect:

Worst performance pushback connect:

Pushback connect process



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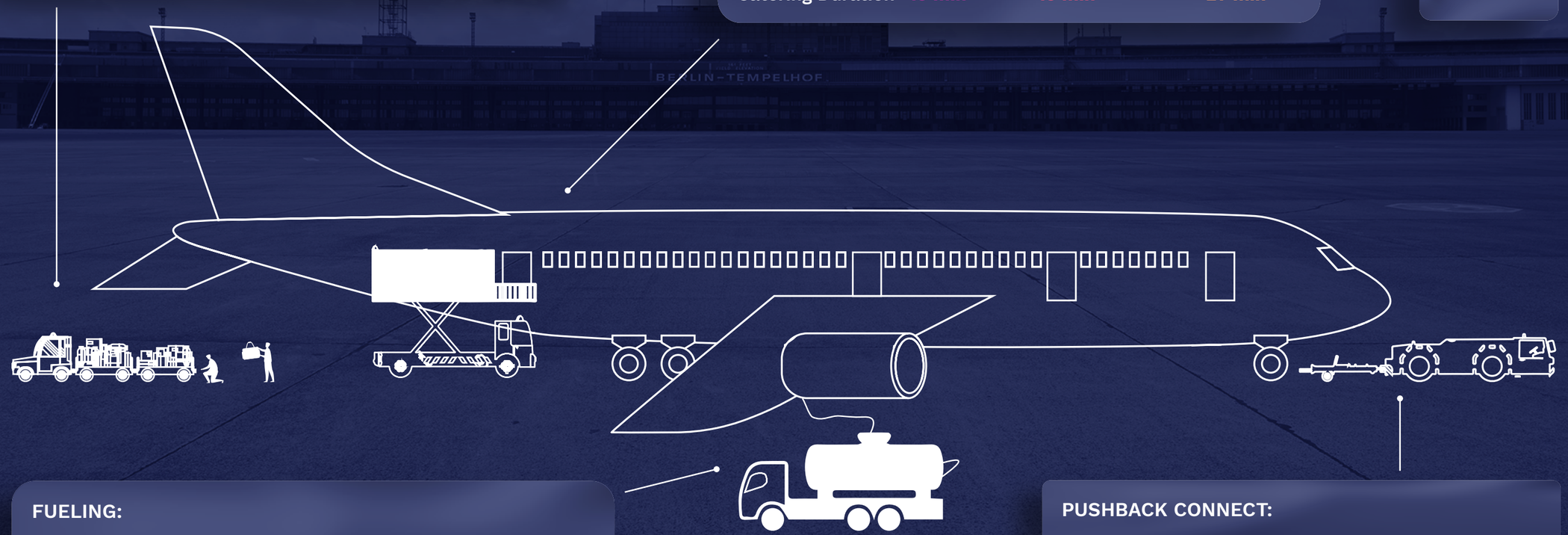
Key learnings

The key learning is that, generally speaking, turnaround tasks need to be carefully sequenced to generate the greatest possible efficiency. That requires a comprehensive overview of the entire process and careful planning based on real-time data, which results in better on-time performance.

UNLOADING AND LOADING:			
Unloading Start	A +1 min	A +1 min	A +2 min
Loading End	D -10 min	D -6 min	D -1 min

CATERING:			
Catering Start	D -73 min	D -57 min	D -44 min
Catering End	D -54 min	D -38 min	D -17 min
Catering Duration	19 min	19 min	27 min

Key:
- Best
- Middle
- Worst



FUELING:			
Fueling Start	D -57 min	D -47 min	D -37 min
Fueling End	D -44 min	D -34 min	D -25 min
Fueling Duration	12 min	13 min	13 min

PUSHBACK CONNECT:		
D -55 min	D -27 min	D -7 min

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Sustainability

The main focus in this Report is the cost of time. However, the turnaround also incurs dollar and environmental costs, because of avoidable fuel burn.

The most stark representation comes from the times aircraft are connected to ground power and, therefore, when they are not using their Auxiliary Power Unit (APU).

The key figure is that APUs run for an additional **16 minutes for the worst performers**.

APUs typically consume 1.7 kg of fuel per minute. Therefore, this reduced use of ground power equates to 27.2 kg of extra fuel. At today's prices, that means approximately $26. IATA's current figures suggest an airline makes a profit of $2.25 per passenger on a short-haul flight. Therefore, that additional APU usage equates to the profit from 11 passengers.

It also means 85.96kg of CO_2 emissions, based on the widely accepted ratio of 3.16kg of CO_2 produced for each 1kg of aviation fuel used. That makes it the second biggest source of greenhouse gas emissions at the airport, after aircraft taxiing. And it is largely avoidable.

Turnaround delays contribute to increase in:

Financial Costs and Environmental Cost

Financial and environmental cost per 16 minute delay:

APU usage

27.2 kg = $26 =

Fuel

Equivalent to profit from 11 passengers

Estimated average CO_2 emissions per 16 minute delay:

16 mins — 85.96 kg CO_2 — **Per flight**

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The caveat is that the source of the ground power could also involve the production of CO_2 emissions.

A thorough analysis of airport power usage would be needed to quantify that. However, grid utility providers produce power more efficiently than an aircraft engine. Also, airports around the world are increasingly using power from renewable sources, as well as using their building infrastructure to generate power, such as roof-based solar.

A second sustainability measure is the use of pre-conditioned air (PCA).

The alternative to PCA is using power from the aircraft's main engines or the APU to run the aircraft's internal air conditioning system. It is harder to quantify the costs of not using PCA in the same way as ground power usage because the PCA is not required for every flight and there are many more variables.

However, the time the PCA was not connected was **23 minutes less on the best performing turnarounds compared to the worst**. There can be no question that the PCA represents a better and more efficient use of resources, even if it is not possible to put an exact financial and environmental cost against it.

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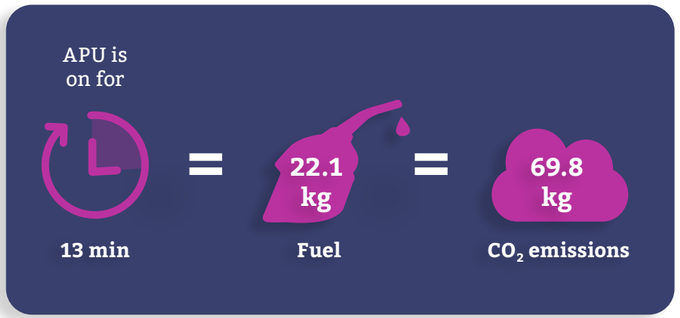
Best performance

Ground power:

PCA:

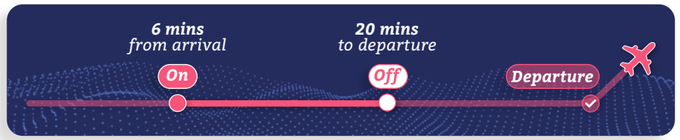
APU:



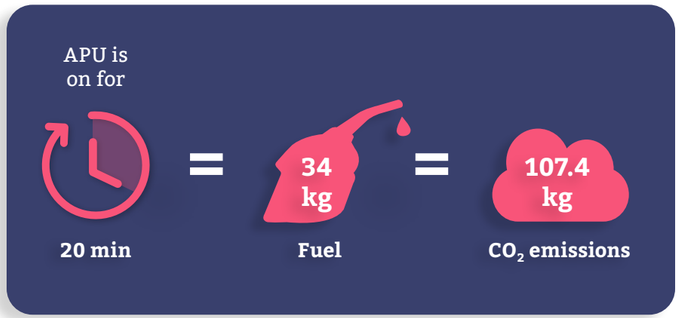
Middle performance

Ground power:

PCA:



APU:

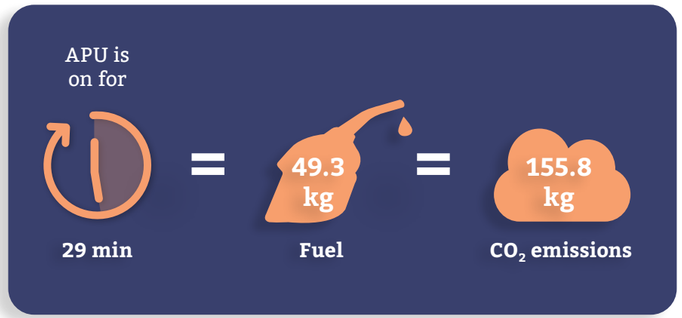


Worst performance

Ground power:

PCA:

APU:



Difference between best and worst performance during time APU is on:

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According to IATA the combustion of 1 kilogram (kg) of jet fuel in an aircraft engine produces 3.16 kg of carbon dioxide (CO_2).
www.iata.org/contentassets/922ebc4cbcd24c4d9fd55933e7070947/icop_faq_general-for-airline-participants

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Improving Performance

The findings of the Report very clearly show there is significant potential to gain efficiency during the turnaround.

On its own, this will not put an end to flight delays. However, it will help improve on-time performance by removing one major cause of delays.

This requires universal monitoring of the turnarounds. Assaia does that by applying Artificial Intelligence (AI) Computer Vision technology to provide airports and airlines with complete visibility of turnaround operations at the airport. We monitor the hundreds of tasks carried out by scores of people at the turnaround so airports and airlines can free up gates faster, increasing efficiency, reducing delays, improving safety and cutting CO_2 emissions.

Assaia's technology is in operation at a number of airports across North America, Europe, the Middle East and Asia-Pacific, where we work with the airport authorities, airlines and ground handlers.

What we see from our operations, which is firmly reflected in this report, is the discrepancy between the best and worst turnarounds. Using AI computer vision, we can help close that gap very quickly. The result is more efficient use of the gate and aircraft, reducing ground delays by four to five minutes, leading to a better on-time performance, which ultimately improves the passenger experience.

ASSAIA

Our technology gives airports and airlines control over turnaround operations, providing three layers of action.

1. The first is to predict issues and automate processes to make them more efficient. Knowing exactly what is happening at the turnaround, and having a full understanding of the inefficiencies, results in better management.

2. The second layer is constant monitoring, with the technology being set to provide real-time alerts to the relevant managers when an activity does not happen, or when something goes wrong. For example, an alert could be sent if ground power is not in operation by a certain time. Another alert could notify managers if a ramp agent is standing in the wrong place just before pushback.

3. Finally, reporting and analysis allows for root cause understanding, process improvement and staff training.

The number of airports and airlines deploying turnaround monitoring technology is increasing all the time. We expect to see improvements in next year's Turnaround Benchmark Report.

> "As an airline dedicated to maintaining our exceptional on-time performance and award-winning customer experience, this report emphasizes the crucial role data visibility and corresponding action play in driving this experience.
>
> **Pasha Saleh**, Head of Corporate Development, Alaska Airlines

ASSAIA

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