ENHANCED ESTIMATED TIME OF ARRIVAL

The Future Of Flight Following

New flight-following data improves operational efficiency and, therefore, cuts costs for airlines and improves the overall travel experience for their customers. The next advancement in using improved aircraft situational displays such as Sabre AirCentre Flight Explorer is to derive enhanced estimated time of arrival so airlines can accurately and dynamically calculate when a flight will arrive and/or depart, removing the guesswork from the equation.

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Most people have experienced a time when they arrive at the airport en route to see family, take that long-awaited vacation or attend an important business meeting. When they arrive, they are frustrated to find an unusually long taxi time across the entire airport, forcing them to miss their connection, and causing them to wait for hours to be rebooked.

Or perhaps even worse, they are trying to make a tight connection, but upon arrival they find out they have been rebooked on another flight when the airline assumed they wouldn't make the connection, even though the flight arrived in plenty of time.

It is not easy to be a happy passenger in such situations. Meanwhile, behind the scenes of the airline and airport operations, the negative effect of these situations can be extreme. In most cases, one delayed flight or one missed connection will cause a chain of delays down line.

A day of reaccommodating passengers, swapping aircraft, reassigning crewmembers and managing ground operations is inefficient and costly. The operations controller, flight planner and underwing staff all rely on accurate arrival and departure times to keep the operation running smoothly and as planned. However, when a flight has an unexpectedly long taxi time or endures unpredictable en-route delays, it leaves everyone wondering when the flight will actually arrive at the gate.

The solution to this problem can truly enable smoother operations, and the lack of it will likely create chaos.

There are many factors affecting a flight's estimated time of arrival (ETA), many of which are uncontrollable by the operator. Air-traffic-control (ATC) reroutes, holding patterns, congestion, maintenance, incoming aircraft delays and weather can all impact the ETA. Onboard avionics provide ETA updates during the flight; however, they are based on known variables such as the flight plan and winds and do not take into account possible ATC delays or ground delays. Additionally, some flight-management computers send a final ETA at the top of descent based on the current route, and any deviations after this point will not be recalculated into an ETA, leaving the airline in the dark as to when the flight will actually arrive.

Then once a flight lands, there is still unpredictability in how long the aircraft will take to taxi to the gate, depending on runway-to-gate distance, congestion and closures.

Most airlines apply a static taxi time such as 10 minutes to all aircraft at a specific airport; however, this does not provide an accurate estimation, especially given the growing size and congestion at many airports.

Historically, the effect of the combination of all of these factors on a flight's ETA has been deemed unpredictable and, as a result, the overall ETA can be consistently inaccurate,

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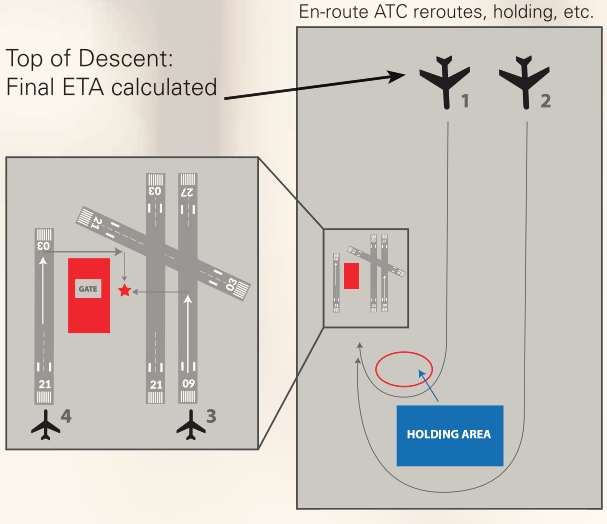

More Precise Decision-Making Flights 1 and 2 have the same estimated time of arrival as calculated at top of descent but take different paths to the gate. Flight 1 is put into a holding pattern and Flight 2 is given a long downwind approach by ATC, delaying both of their arrival times. On the airport surface, flights 3 and 4 are landing at the same time and headed to adjacent gates but with different runways and distances. Flight 4 will arrive much later than flight 3. An enhanced ETA is able to recognize these factors and accurately predict the ETA, allowing airlines to make more efficient decisions and not rely on inaccurate ETA predictions.

causing passengers to miss connections and airlines to miss their targets.

Today, new and expanding data sources, like ADS-B, are giving visibility into areas that were previously unknown, such as airspace outside of ANSP radar coverage and airport ground coverage. As a result, airlines are able to receive high-frequency position updates from their fleet from all over the world, even on the airport surface. These data sources give airlines significant operational benefits such as a flight that is put into a holding pattern outside of ANSP radar coverage can now be recognized. Or a flight given a long downwind approach by ATC can now be recognized and potential delays as a result can be addressed proactively.

On the airport surface, ADS-B combined with ASDE-X data from the U.S. Federal Aviation Administration can give visibility into possible taxi-time delays. This visibility allows airlines to accurately track taxi times and quickly determine when a flight will take off or arrive at the gate by looking at congestion and location.

This increased situational awareness both en route and on the surface is important as a graphical tool for flight following; however, the real value in this data is that it powers effective decision-making.

Operational decision-making is made difficult by the fact that airlines are frequently left in the dark in terms of actual aircraft data, whether relating to high-frequency position reports from their own aircraft or the activity of other airlines in the area. Operational decisions are often made regarding passenger connections, gate planning and delays based on broad assumptions about taxi time and ETA or guesses about when a plane will actually make it to the gate.

Sabre AirCentre Flight Explorer is looking to develop these data sources into a dynamic, accurate and actionable ETA. It is called an enhanced ETA because it takes into account projected taxi times, congestion, holding patterns and actual aircraft position to calculate a more precise ETA in all phases of flight and in many more geographic locations than currently available.

An enhanced ETA would be calculated and utilized in two phases of estimation: predictive and dynamic.

Predictive ETA

In flight planning, prior to departure, a predictive ETA could be calculated based on historical data and current trends. Historical data would be analyzed to determine previous runs of a specific city pair at a particular time on a given day to look for patterns on possible ETA impacts including ATC delays, congestion, weather and taxi times. Present-day trends would take into account current weather, congestion and recent taxi times. This predictive ETA would provide airline operations analysts a much clearer picture into the flight as they plan for fuel, gate times, staffing and hub management.

Dynamic ETA

Upon departure, and throughout the flight, the dynamic ETA would be continuously updated based on real-time conditions. The flight plan, actual flight flown, en-route weather, terminal weather, ATC patterns, actual taxi times and weather forecasts would all be evaluated to calculate the dynamic ETA. This information is critical at key points such as passenger rebooking, connection decisions and gate planning.

Moreover, the enhanced ETA could be used to automate decision-making across an airline's operation through tight integration with other business areas and systems. As such:

- Ground crews can be sent to a gate with a plane that is arriving on a nearby runway with a five-minute taxi time instead of to a gate where a plane is landing at the same time across the airport with a projected taxi time of 20 minutes. This improves efficiency and ensures a ground crew is waiting at the gate when the plane arrives.
- Operations software can determine the most efficient aircraft tail swap or disruption-recovery plan based on accurate ETA information.
- Managing connections becomes much more efficient when an accurate ETA is included as a data input. Broad assumptions on if passengers will make a connection is replaced by accurate times to ensure the correct decisions are made.
- Passengers can be notified if the incoming aircraft for their outbound flight is delayed based on the enhanced ETA. The data could also be used to rebook passengers, if necessary, or notify them so they can elect to rebook to another flight.

In the future, as more and more data becomes available and position reports come in at even higher frequencies, this type of analysis could be used to determine the cause of historical delays and assist in creating more efficient flight schedules and resource utilization by predicting early or late flights. As a result, the passenger experience could be significantly improved by automatically informing passengers of predicted delays or predicted early arrivals, giving adequate notice to change plans if necessary or to ensure ground transportation arrives at the correct time.

As airlines look to use data and automation to improve operational efficiency, reduce costs and enhance the overall travel experience, the availability of new flight-following data cannot be overlooked. With improved aircraft situational displays and enhanced ETAs, airlines are beginning to accurately and dynamically calculate when a flight will arrive and stop relying on assumptions. By incorporating this calculation into decision-making, the guesswork can be removed from the equation.

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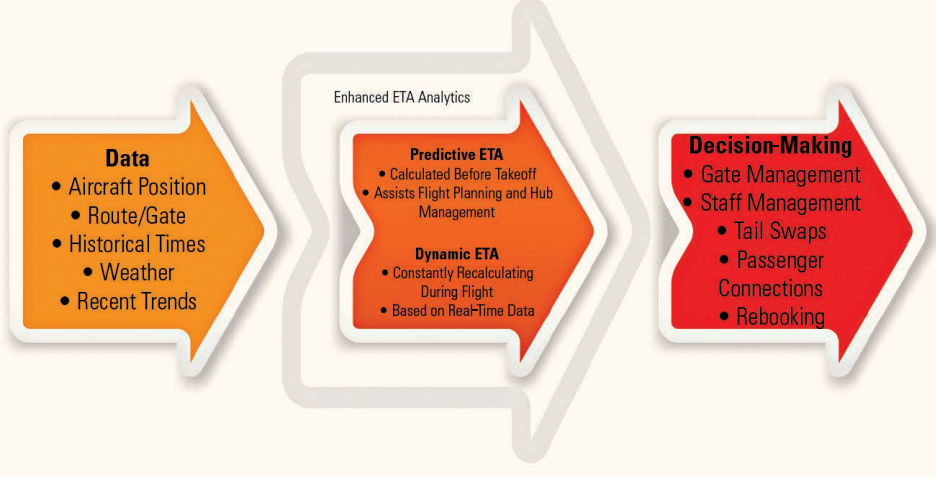

Enhanced ETA Process By applying analytics to the enormous amount of data that is available in flight following, an enhanced ETA can be calculated, which supports efficient decision-making.

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